

Windows 2003

HP StorageWorks XP Hardware Providers administration guide

XP128
XP1024
XP12000

product version: 2.8
first edition (February 2005)
part number: T1634-96030

This guide explains how to install and administer HP HWP for use with HP XP disk arrays and Windows Server 2003.



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HP StorageWorks Hardware Providers for Windows 2003: Administration Guide

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About this guide

This guide explains how to install and administer the HP StorageWorks VDS and VSS Hardware Providers (HWP) software for HP StorageWorks XP disk arrays. The XP models to which this guide applies are the listed on the front cover.

Intended audience

The instructions in this guide are intended for system administrators who already have the following skills and knowledge:

- Experience with HP disk arrays, LUN configuration, security, and related products
- Familiarity with HP disk array software
- Experience with the Windows 2003 operating system

This document does not provide detailed information about the disk arrays or using disk array software. Refer to the disk array hardware and software documentation if you need more detailed information.

For more information about HP StorageWorks products, please contact your HP account representative, or visit HP online:

<http://www.hp.com>

Disk arrays

Unless otherwise noted, the term *disk array* refers to any of the disk arrays listed on the title page of this document.

Related documentation

HP provides the following related documentation:

- *HP StorageWorks RAID Manager XP: User's Guide*
- *HP StorageWorks Disk Array XP: Owner's Guide*
- *HP StorageWorks Business Copy XP: User Guide*
- *HP StorageWorks Hardware Providers Supported Configurations*

For HP Hardware Providers documentation and software downloads, see the following web location:

www.hp.com/support/vssvdshwp

For information about Windows software, operating system commands, and third-party products, refer to the manufacturer's documentation.

Getting help

If you have questions after reading this guide, contact an HP authorized service provider or access our website:

www.hp.com

HP storage website

The HP storage website has the latest information about this product, as well as the latest drivers. Select the appropriate product or solution from this website:

thenew.hp.com/country/us/eng/prodserv/storage.html

HP technical support

Telephone numbers for worldwide technical support are listed on the HP website:

thenew.hp.com/country/us/eng/support.html

From this website, select the country of origin.

Be sure to have the following information available before calling:

- Technical support registration number (if applicable)
- Product serial numbers
- Product model names and numbers
- Applicable error messages
- Operating system type and revision level
- Detailed, specific questions

For continuous quality improvement, calls may be recorded or monitored.

HP authorized reseller

You can obtain the name of your nearest HP authorized reseller by telephone:

United States	1-800-345-1518
Canada	1-800-263-5868
elsewhere	See the HP website for locations and telephone numbers: www.hp.com

Conventions

This guide uses the following text conventions.

page 1	Blue text represents a cross-reference. For the online version of this guide, the reference is linked to the target.
www.hp.com	Underlined, blue text represents a website on the Internet. For the online version of this guide, the reference is linked to the target.
literal	Bold text represents literal values that you type exactly as shown, as well as key and field names, menu items, buttons, file names, application names, and dialog box titles.
<i>variable</i>	Italics indicates that you must supply a value. Italics is also used for manual titles.
<code>input/output</code>	Monospace font denotes user input and system responses, such as output and messages.
<i>Example</i>	Denotes an example of input or output. The display shown in this guide may not match your configuration exactly.
[]	Indicates an optional parameter.
{ }	Indicates that you must specify at least one of the listed options.
	Separates alternatives in a list of options.

Revision history

February 2005

New manual covering XP arrays only.

Warranty statement

HP warrants that for a period of ninety calendar days from the date of purchase, as evidenced by a copy of the invoice, the media on which the Software is furnished (if any) will be free of defects in materials and workmanship under normal use.

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Overview

This chapter describes the HP StorageWorks Hardware Providers (HWP) for Windows 2003 and explains how they operate with Microsoft's operating system and applications.

When you have read this chapter, you should have a functional understanding of the Hardware Providers that will prepare you to install the providers and get them working.

Simple overview

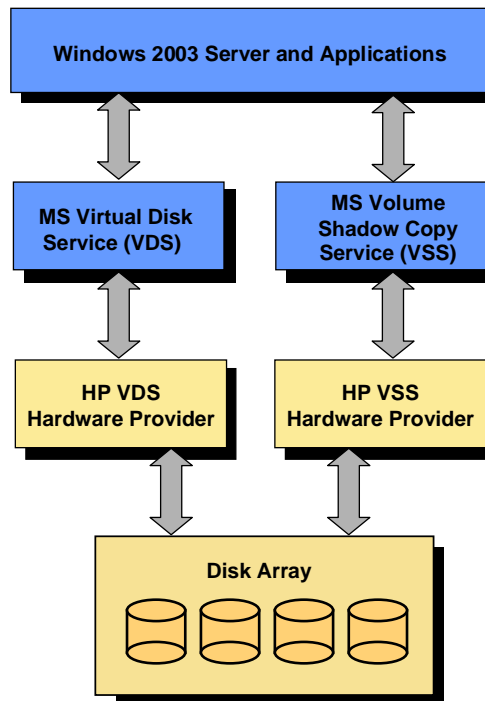
HP StorageWorks Hardware Providers for Windows 2003 are solutions that are installed on a Windows 2003 server connected to an HP disk array.

There are two providers associated with two Microsoft storage services:

- HP VDS HWP and Microsoft Virtual Disk Service (VDS)
- HP VSS HWP and Microsoft Volume Shadow Copy Service (VSS)

The purpose of the Hardware Providers, together with the Microsoft services, is to enable the Windows OS and applications to do these tasks:

- VDS: manage the disk array using the Windows OS and applications
- VSS: create copies of data on array volumes for backup



Detailed overview

HP Hardware Providers enable Windows and its applications to use Microsoft VDS/VSS services to manage certain functions on the disk array.

Virtual Disk Service (VDS)

The VDS service provides the capability of Windows and Windows applications to recognize the HP disk array and perform basic and dynamic disk management functions.

- Microsoft Management Console (MMC) Snap-in, Disk Manager and DiskPart command line interface use the VDS service.
- When used with HP VDS HWP, Windows and Windows applications can perform disk array LUN and port management tasks normally performed using proprietary array control software.

Volume Shadow Copy Service (VSS)

Through the HP VSS HWP, the VSS service provides mirroring of the active files or databases on primary array volumes to secondary array volumes for backup and restoration. The service performs these functions:

- Coordinates with business and backup applications to control the disk array through the HP VSS HWP to make copies of array volume(s)
- Makes full copies of data, called **volume shadow copies**, **clones**, or **plexes** by Microsoft. (See the [Glossary](#).)

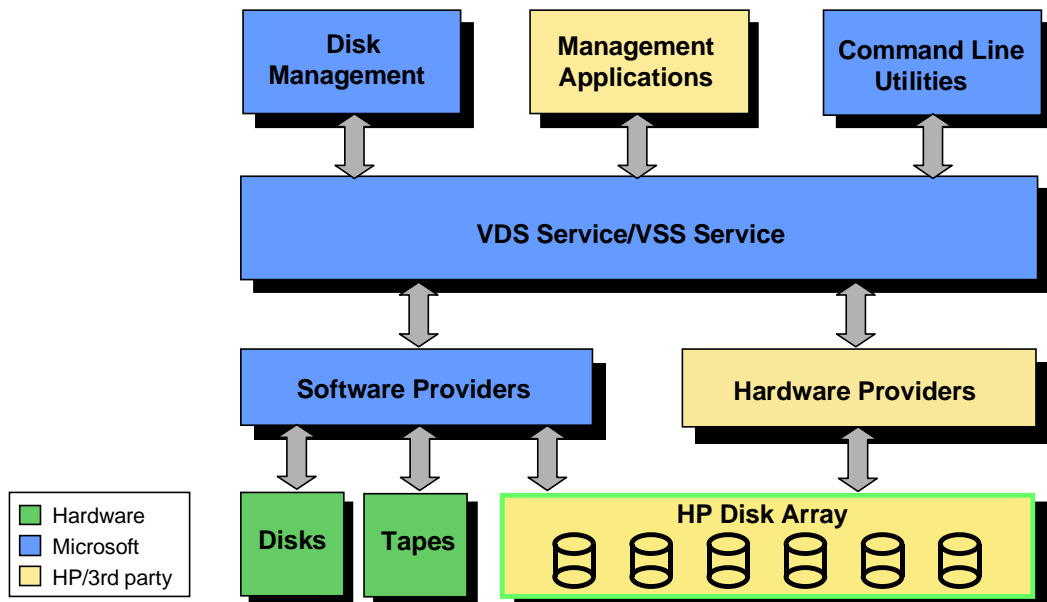
For detailed information about the Microsoft VDS and VSS services, see this Microsoft website:

<http://www.microsoft.com/windowsserversystem/storage/technologies/shadowcopy/stormgtusingvdsvss.mspx>

Functional components

The process of managing array volumes using VDS/VSS and HP HWP involves the following components:

- Microsoft Windows Server 2003 OS
- Windows Disk Management
- Management Applications, such as HP FRS and third party programs
- Microsoft Command Line Utilities
- Windows Software Providers
- Windows VDS Service/VSS Service
- HP VDS/VSS Hardware Providers
- HP Disk Array System



Microsoft Windows Server 2003 operating system

HP Hardware Providers and Microsoft's VDS and VSS services work under the control of the Windows Server 2003 operating system. The Windows OS operates the servers to which the disk array is attached and supports the applications, services, and providers that store and retrieve data on the array and manage array disks and volumes.

Windows Disk Management

Windows Disk Management consists of the Windows software and user interfaces that enable you to manage disks, volumes, and file systems. The user interface for disk management is included in the Computer Management tool within the Administrative Tools Control Panel.

Management applications

Third party management applications, such as HP StorageWorks Fast Recovery Solution (FRS), work with the Microsoft VDS and VSS services to allow you to manage array disks and volumes and to perform data backup and restoration. For more information about FRS, see the *HP StorageWorks FRS XP Administration Guide*.

Microsoft command line interfaces

Microsoft offers two command line utilities: DiskPart and DiskRaid. These interfaces enable you to script disk management tasks so you can automate configuration of multiple storage disks.

The DiskPart utility, which comes standard with Windows XP and Windows Server 2003, manages disks, volumes, and partitions. Using DiskPart, you can use the command line to manage the disk array.

The DiskRaid utility, which comes with the Windows 2003 Server Resource Kit, configures hardware RAID storage systems. It works with any storage hardware that includes a VDS hardware provider, including HP arrays using the HP VDS HWP. DiskRaid has a command syntax similar to

DiskPart. Note that if you display LUNs, DiskRaid shows LUNs in decimal rather than in the hexadecimal format used in Command View.

Windows software providers

The Microsoft Software Providers (called Basic Disk Provider and Dynamic Disk Provider) interface between the Windows OS, Windows applications, and disks, drives, and disk arrays. Through these software providers and VDS, Windows sees the disks, drives, and disk array volumes and performs actions such as partitioning, mounting, and managing the file system.

Other Windows software providers (not shown) are the in-box providers: Windows Backup utility and Windows Microsoft Software Shadow Copy Provider. The Backup utility works with VSS to perform volume shadow copy backups and restorations. Microsoft Shadow Copy creates “copy-on-write” snapshots of data, such as shared folders. These providers are useful for individual backup and recovery of user volumes and files.

Many third party software providers also take advantage of the VDS and VSS services. Well known manufacturers produce software providers and applications that work with HP storage. HP Hardware Providers are not required in order for the Microsoft or third party software providers to perform the tasks described above on the HP disk arrays. However, the HP HWPs extend the capabilities of various Windows providers and applications to do additional tasks that normally require the use of proprietary HP array management software. Such tasks include LUN and port management and more sophisticated volume copying.

Virtual Disk Service (VDS)

Microsoft VDS provides an interface for managing volumes and logical units. Administrators can identify, configure, and monitor supported HP StorageWorks disk array volumes from the Windows Server 2003 Microsoft Management Console (MMC).

When used with HP disk arrays, VDS manages the array to make it appear like a Windows disk for Windows applications. When you use Microsoft

Management Console, Windows Disk Manager and the Microsoft DiskPart or DiskRaid utility to control the array, your commands are sent to the array through VDS and the software or hardware providers.

VDS performs the following functions:

- Coordinates all providers and clients (local and remote)
- Performs binding
- Discloses hardware LUNs to software disks
- Performs common file system functions
- Monitors volume status
- Provides fault and performance tracking
- Includes an API layer

Volume Shadow Copy Service (VSS)

VSS enables the Microsoft Windows Server 2003 operating system to create shadow copies of data for backup and recovery. VSS creates shadow copies across multiple volumes in coordination with HP's Fast Recovery Solution or other third party business applications, file-system services, backup applications, and storage hardware. The features available to you with VSS depend on the features of the Windows applications working with VSS to create shadow copies. The features of the applications whose data is copied and the capabilities of the disk array also affect the overall feature set available in a particular implementation.

Copy terminology

Understanding the terminology makes it easier to understand what VSS does. Microsoft generally refers to a VSS copy as a "volume shadow copy." This is a read-only point-in-time backup replica of an original volume's contents. It is keyed with a GUID to allow identification of the parts of a shadow copy set that span multiple volumes. Common equivalent industry terms are "clone" and "mirror."

After a volume shadow copy is made, VSS can coordinate updates to the copy by employing copy-on-write updating. This method of updating writes each data change to the backup volume before changing the original

volume. This process keeps the original data volume and the backup volume synchronized.

When a backup volume is split from the original so that the backup is no longer synchronized, it becomes a standalone static copy of the original at a particular point in time. Microsoft refers to this type of copy as a “plex,” but it is more commonly referred to in IT as a “split mirror.”

If the disk array has the capability, VSS can also create “snapshots” of volumes. This is a virtual point-in-time copy of an original LUN that does not contain all of the original data. Instead the copy consists of a bitmap containing pointers to the data on the original LUN.

The advantage of the snapshot is that a copy is made very quickly (as fast as the bit map can be created), and the copy becomes available for use almost immediately. The disadvantage is that the copy does not actually contain the original data, which could result in data loss if the original data becomes damaged. In addition, any I/O operation against the snapshot (for example, streaming to tape or integrity checking) affects performance of the original volume.

Another term you may encounter is “snapclone.” This is an HP EVA disk array term. An EVA Snapclone is a complete clone copy of a specified Virtual Disk (LUN). EVA snapclones are available almost immediately. This is accomplished by taking a snapshot and making it immediately available while continuing to copy data in the background.

HP VDS/VSS Hardware Providers

Windows Server 2003 sees, partitions, mounts, and manages file systems on the disk array using its own software providers. HP's Hardware Providers extend the array management capabilities of Windows and its applications to include functions normally performed using the disk array's proprietary control software. These functions include managing disk array LUNs and ports and performing volume copy operations.

There are two HP HWP installation executables for each HP disk array model, one installation executable for VDS and one for VSS. These installation executables are different for each HP disk array model.

The HP Hardware Providers installation executables install the HWP files in your Windows Server file system. The files installed consist of special sets of HP DLLs and executables, one set for VDS functions and another set for VSS functions. These components extend the array management capabilities of Windows and its applications. Because they are installed separately, you can choose to install only the VDS or VSS HWP or both.

For VSS only, HP's Business Copy (BC) application, which installs on the disk array and is licensed in Command View, works with the VSS and the HP HWP components to enable the array to make VSS shadow copies. For functional purposes, you can think of BC as a part of the hardware providers, even though it is installed separately.

HP disk arrays

Specific HP Hardware Providers have been created to work with selected models of the HP XP and EVA disk arrays. Different supporting technologies and features within the arrays result in some differences in their methods and capabilities of performing VDS/VSS tasks.

HP XP array and VSS

To use the XP array with VSS and HP HWP for backup and/or recovery, you preconfigure it to contain a number of primary volumes (PVOLs) where Windows applications store original data and an identical set of secondary volumes (SVOLs) where volume shadow copies are stored. These matched sets of primary and secondary volumes are called pairs.

When a requestor application requests a VSS shadow copy, the XP array clones an exact copy of the primary volumes, places it on the secondary volumes, and splits the volume pair. Splitting the volume pair leaves the copy on the secondary as a static, independent read-only copy of the original.

See the *Command View XP User Guide* for additional details about XP copy features.

HP HWP typical applications

The following examples demonstrate typical applications of the Hardware Providers when used with the Microsoft VDS, and VSS software components. Many more scenarios are possible.

VDS typical applications

The advantage of VDS and the HP VDS HWP is that they allow you to manage the HP disk array using the Windows interface. Array management tasks that would normally require the array's proprietary management application can be done using VDS and the third party Windows management application of your choice. When you have multiple array models, this is particularly helpful because you can manage all arrays from a single interface.

VSS typical applications

VSS shadow copies made on the disk array with the help of the HP VSS HWP can be used for these purposes:

- Consistent backups of open files and applications
- Transportable shadow copies for backup, testing and data mining
- Fast recovery of files and data

Consistent backups of open files and applications

VSS captures data files from running applications by taking a snapshot of the data at a point in time, minimizing interruption to the applications. This process may include cooperation from the applications, which notify the operating system that they are momentarily pausing. During this time, the applications make data on the disk consistent by performing actions such as flushing buffers to disk or writing data in memory to disk. The resulting backup data copies are typically temporary, maintained for some limited period of time until they are superseded by newer backup copies.

Shadow Copy Transport

Shadow copy transport requires Windows Enterprise or DataCenter edition. Using a server configured with suitable applications together with VSS and the HP HWP, you can create shadow copies and import them onto other servers connected to the same disk array. This enables multiple servers to make use of the same data, allowing data mining or testing on those servers. (However, shadow copies are read-only. If you need to write to a shadow copy, you must use a storage-management application that works with VDS/VSS to convert the copy to read/write.)

You can also use VSS and HP HWP to create and transport shadow copies from the primary server onto a backup server, and then back up the shadow copy volumes to tape. The advantage of this solution is that it relieves the primary server of backup traffic. Additionally, shadow copies can be made more often than tape backups because the copying process is faster than tape and doesn't require taking the database offline.

Fast Recovery

HP StorageWorks FRS Fast Recovery is an HP management application that works with VSS and HP VSS HWP. Using FRS, you can create point-in-time shadow copies and use them to perform quick recovery of an Exchange Server storage group or an SQL database. Whether the database is lost because of a hardware failure or software corruption, it can be restored in minutes.

Configuration

This chapter lists required hardware and software components and explains how to configure the disk array and Windows 2003 servers for use with HP Hardware Providers (HWP). You must complete the procedures in this chapter before you install HP HWP. Follow all configuration and installation instructions carefully.

IMPORTANT NOTE: The right combination of software versions is crucial to configuring a working system. Refer to the *HP StorageWorks Hardware Providers Supported Configurations* document and any README files accompanying the HP HWP installation files for information about compatible software versions and system configurations.

For HP Hardware Providers documentation and software downloads, see the following web location:

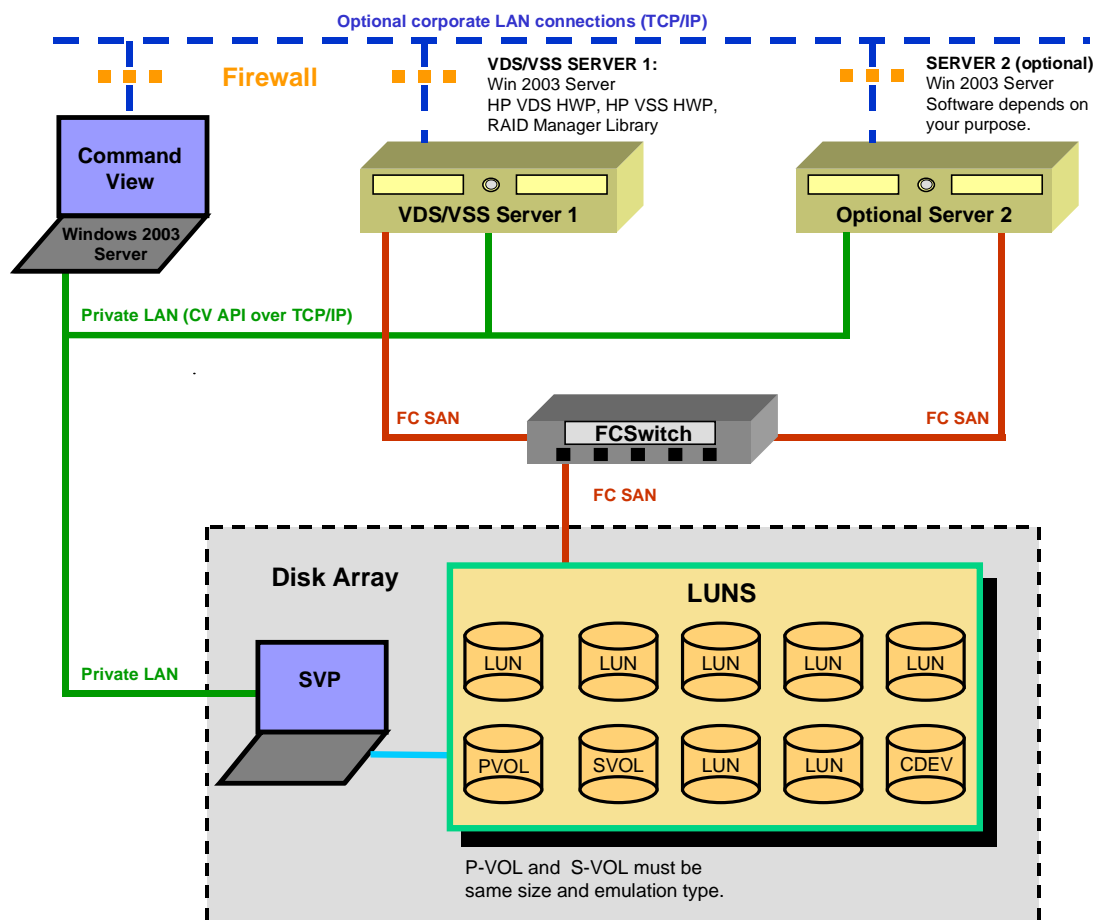
www.hp.com/support/vssvdshwp

Required components

The following illustration summarizes the hardware and software in a fully configured system. Note that a second server is not needed for VDS and is optional for VSS; it may be useful if you want to manage VSS backup data on the secondary volumes without burdening the primary server.

The following pages describe configuration details.

HWP Configuration Diagram XP



Required hardware components

- **HP StorageWorks Disk Array:** XP128, XP1024, or XP12000 with Business Copy firmware license installed by HP.
- **Windows Command View workstation** with Windows Server 2003 or Windows Server 2000 SP4 for connecting to the array. Command View, Business Copy licensing, and SNMP software must be installed.
- **Windows VDS/VSS Server** with Windows Server 2003 (VSS requires Enterprise or DataCenter Edition for transportable snapshots; VDS works with any edition). A fast 2+ GHz CPU, 1 GB of memory, and 1 GB or more of disk space are recommended. This primary server manages the primary data on the primary volumes (PVOLs) of the array and contains applications (such as Exchange or SQL), VSS/VDS, HP HWP, and RAID Manager Library software.
- **Windows Server 2 (optional)**—A secondary server *may* be connected to the array if you want to manage the VSS copies on the secondary array volumes (SVOLs) without burdening the VDS/VSS server. Depending on your purpose for this server, you may need to install the HP HWP and RAID Manager Library software and your application software.
- **Fibre Channel Host Bus Adapters (HBAs)** in each server for connecting to the disk array via a Fibre Channel SAN.
- **Fiber cables and fabric switch** to connect the hosts to the array. (A fabric switch is optional; you can use direct connections if you prefer.)
- **Ethernet network interface cards or built-in ports** in each server for connecting to Ethernet LANs.

Required software components

The following software is required to run HP HWP.

IMPORTANT NOTE: Correct software versions are crucial to operation of the Hardware Providers. Check the README file accompanying the HP HWP software for required versions.

Command View management station

- Windows 2003 Server or Windows 2000 Server with Service Pack 4 (SNMP must be enabled for SVP communication)
- Command View with Business Copy license
- Access.txt file containing server IP addresses

VDS/VSS Server

- Windows Server 2003 (Enterprise or DataCenter Edition is required if you wish to transport snapshots)
- HP VDS HWP (for array management)
- HP VSS HWP (for shadow copying)
- HP RAID Manager Library XP
- Microsoft QFEs (quick fixes), if required for your OS, VDS, or VSS. Search the Microsoft website for “quick fixes” and download them.

Secondary Server (optional)

- Windows Server 2003 (Enterprise or DataCenter Edition is required if you wish to transport snapshots)
- HP VDS HWP (optional, for array management from this server)
- HP VSS HWP (optional, for shadow copying from this server)
- HP RAID Manager Library XP (install if you install VSS)
- Microsoft QFEs (quick fixes), if required for your OS, VDS, or VSS. Check the HWP README file and search the Microsoft website for “quick fixes” and download them.

Important configuration notes

The following notes will help ensure a successful configuration:

- Using multiple servers to manage primary and secondary volumes is optional. However, if you do use multiple servers, it is important that they be in the same domain to enable communication.
- Set CV NIC binding so the LAN connecting the servers and Command View has priority (listed first).
- Administrator privileges are required for all devices and software. If you do not have administrator privileges, the software and hardware will not communicate properly.
- A host group specifically named **SVOL** and containing secondary LUNs must be defined for use with VSS. This host group should not have any host paths to it.
- For VSS, the primary and secondary volumes must be the same type and size. There must be at least as many secondary volumes as primary ones. Some applications require more than one secondary volume for each primary volume.
- A command device LUN of 36 MB must be defined for each server running HWP. This LUN cannot be used to store data.
- **Port Security** must be **ON**.

Important performance issues

The following issues can affect the performance of HP HWP:

- Excessive traffic on the Ethernet LAN. A private Ethernet LAN is recommended between the CV station, the array's SVP, and the HP HWP server(s) to prevent excessive traffic.
- Viruses that slow down network traffic. Be sure you regularly run a virus checker.
- A firewall that excessively slows traffic from the CommandView station to the servers hosting VDS/VSS. Any firewall must be open between the CV station and the HP HWP server(s).

Configuration procedures

Physically configure the servers and software as described below and in the manuals for those products. See the overview diagram on [page 26](#). Your HP representative may perform some installation and configuration tasks.

Configuration summary

You will perform the following configuration tasks later in this chapter:

Command View (CV) and SVP

- Install and configure CV on a high speed Windows workstation.
- Connect a private Ethernet LAN between the CV station and the SVP.
- Connect the corporate LAN to the CV station, if desired.
- Add host IP addresses to the CV **access.txt** file.
- Set CV network bindings to list the LAN connected to the servers first.
- Add the disk array to be managed to the list of arrays in CV.
- (*VSS only*) Add a Business Copy license to CV (if not already done).
- Add the CV IP address to the SVP **snmpagt.exe** management page.

VDS/VSS servers

- Install Windows 2003 Server OS, software, and FC HBAs and drivers.
- Connect to the array's FC SAN and private Ethernet LAN.
- If desired, connect to the corporate Ethernet LAN.

Disk array

- Configure array ports for fabric topology and Port Security **ON**.
- (*VSS only*) Add primary and **SVOL** host groups (**SVOL name is required**), and set Host Mode **0C** or **2C**.
- (*VSS only*) Add primary and SVOL (secondary) LUNs.
- Add a 36 MB Command Device (CDEV).
- Add WWNs to the primary host group, but NOT to the SVOL group.

Configuring the Command View server and software

Install and configure the Command View management workstation with the Command View software as explained in the *Command View Installation Guide*. SNMP must be enabled (see Windows Help).

Follow these additional Command View configuration steps:

1. Connect a private Ethernet LAN between the Command View workstation and the array's SVP to allow the Command View workstation to access the SVP. (This may already have been done when the disk array and Command View station were initially installed).
2. Connect the VDS/VSS server(s) to the Command View management station via private LAN.
3. If desired, connect Command View and/or the servers to the corporate LAN.
4. In the **access.txt** configuration file in the following location, enter the private IP addresses of the VDS/VSS servers:

drive\HPSS\dm\tomcat\webapps\hpstmgmt\WEB-INF\cvapi\config

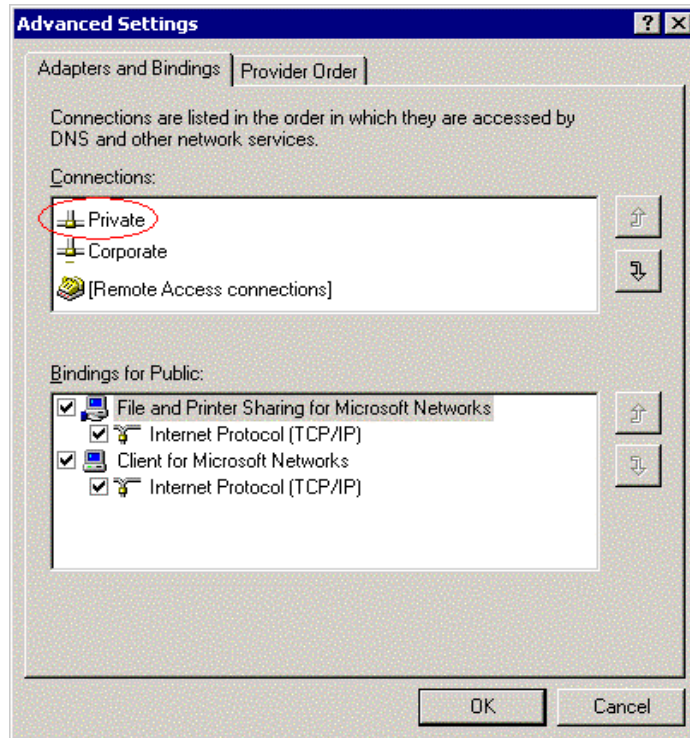
(*drive* is the hard drive where Command View XP is installed.)

For example, enter:

```
localhost  
15.75.*.*  
15.106.*.*
```

localhost is the Command View station. Using wildcards in the server addresses (*) provides any server in the subnets 15.75 and 15.106 access to the array through Command View. If you prefer to give access only to the VDS/VSS server(s), enter their complete IP addresses without wildcards.

5. On the Command View station in the Windows **Network Connections** display, select **Advanced/Advanced Settings**. In the **Advanced Settings** display, set network bindings so that the LAN Command View will use to access the VDS/VSS servers appears *first* in the **Adapters and Bindings/Connections** list.



6. Start the CV GUI by opening a browser window on the Command View station and typing the IP address of the Command View station in the browser's address box.

This starts the Command View GUI, and the login dialog appears.

7. Log into CV as an administrator by entering the Command View administrator's username and password (default login shown below):

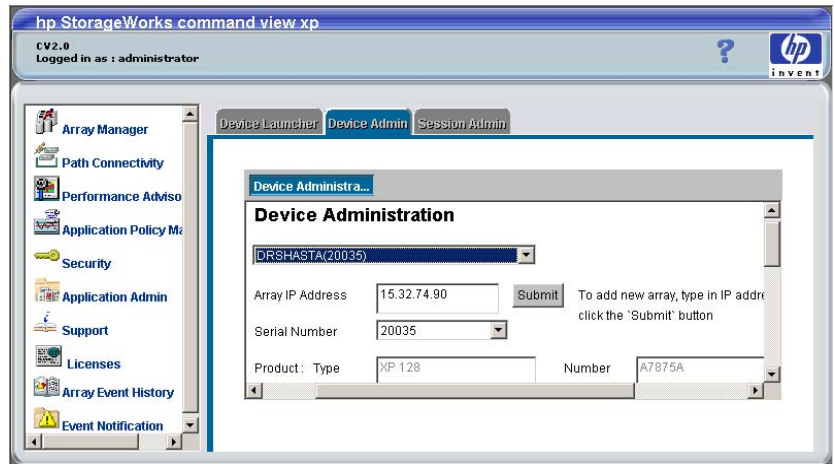
username: **administrator**

password: **administrator**

8. Select **Array Manager** in the left panel and select the **Device Admin** tab.

9. To select the disk array to be managed by Command View, click the drop down menu, or enter the IP address of the disk array in the **Array IP Address** box. (If the desired array is not present in the menu, add the array to the list: Select Array Manager in the left panel, select the Device Admin tab, enter the array's IP address, and clicking Submit. It may take several minutes for the array to be added.)

The Device Administration screen displays the details of the array.



10. Click **Submit** and click **Save** to save the configuration.
11. Restart the Command View services.

Add Business Copy license to Command View:

If you plan to use VSS to make data copies and Business Copy is not already installed, you must install a BC license key using Command View. Before you can install a license in CV, the HP representative must install BC licensing firmware in the disk array.

12. Log into CV as an administrator, and click **Licenses** in the left panel.
13. Click the disk array you want to access from the Serial Number column. The License Key Management main screen opens.
14. Click **Install** on the License Key Management main screen.
15. Select the BC check box, and enter the license key code. (If BC is already installed, the license box is grayed out.) Then click **OK**.

Configuring the SVP server and software

An HP service representative configures the SVP as part of disk array installation. This must include the following steps to configure the SNMP agent on the SVP, which enables CV to control the disk array:

1. *(HP representative only)* On the SVP, open a command line window.
2. *(HP representative only)* At the command prompt, type **snmpagt.exe** to display a dialog window with a property sheet.
3. *(HP representative only)* From the **manager** page, enter the IP address of the Command View management workstation.

This gives Command View control of array management.

4. *(HP representative only)* Reboot the SVP.

Configuring VDS/VSS Server

The VDS/VSS server contains the applications that create and store primary data. Install and configure the server as follows:

1. If it is not already present, install the Windows 2003 OS on the host according to Microsoft's installation instructions.
2. Install a Fibre Channel host bus adapter (HBA) card into the server according to the HBA manufacturer's instructions.
3. Install the HBA driver and utility software onto the server according to the HBA manufacturer's instructions. HP tested drivers are available by searching hp.com; follow the README file for installation.
4. Connect the server to the disk array, either via FC direct-connect or through a fabric switch and SAN topology. If you use a switch, configure it according to the manufacturer's instructions.
5. Connect the server to the private Ethernet LAN that connects to the Command View management workstation and the array.
6. If desired, connect the server to the corporate Ethernet LAN.
7. Complete the rest of configuration in this chapter. Then install the RAID Manager Library, followed by the HP HWP software on the server as explained in [Chapter 3](#) "Installation." RAID Manager Library should be installed before you run the Hardware Provider installation package.
8. Lastly, install any QFEs (quick fixes) from Microsoft for the OS, VDS, or VSS. Search the Microsoft website to find and download QFEs.
Important: this must be done after all applications are installed.

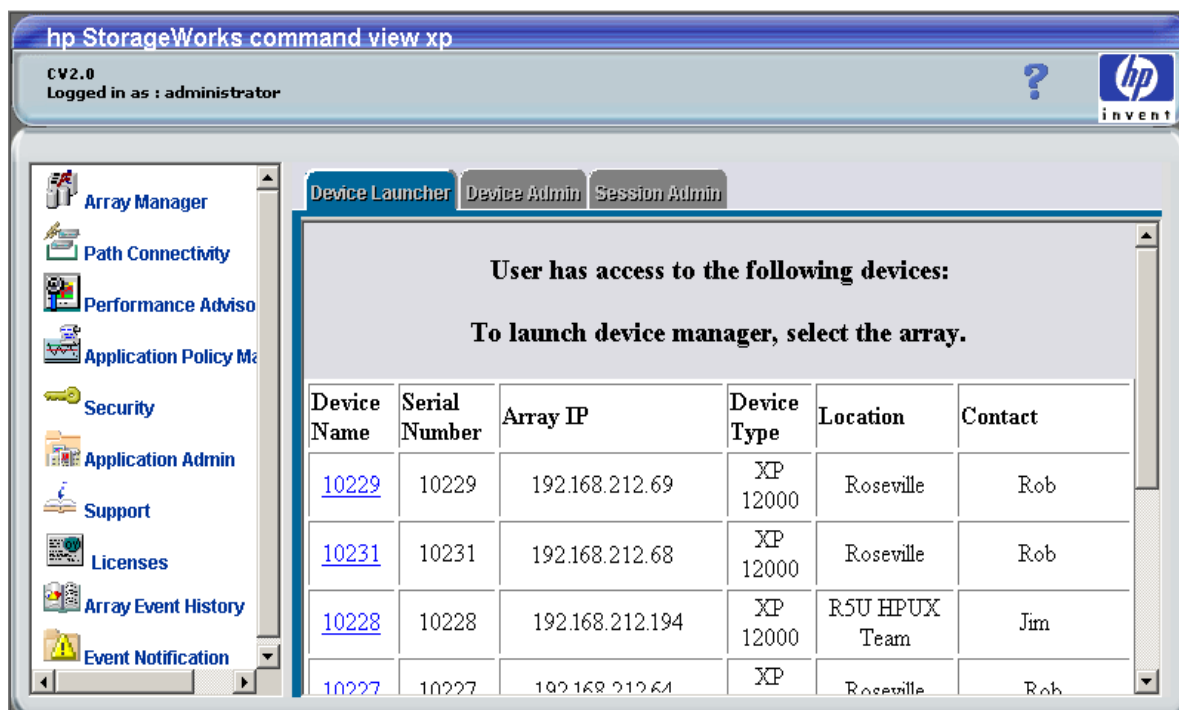
Configuring additional servers

An additional server for managing data on the SVOLs in the array is optional, and its configuration depends on your specific application. If you plan to use additional servers to manage the backup data on the array secondary volumes, install and configure them according to the instructions given previously for the VDS/VSS server.

Configuring the disk array

The following configuration steps are required only if you will use VSS to make volume shadow copies. If you are only using VDS and will not use VSS, you can skip these configuration steps. Illustrations and instructions are for Command View 2.0. Significant differences for Command View 1.8 are given in parentheses.

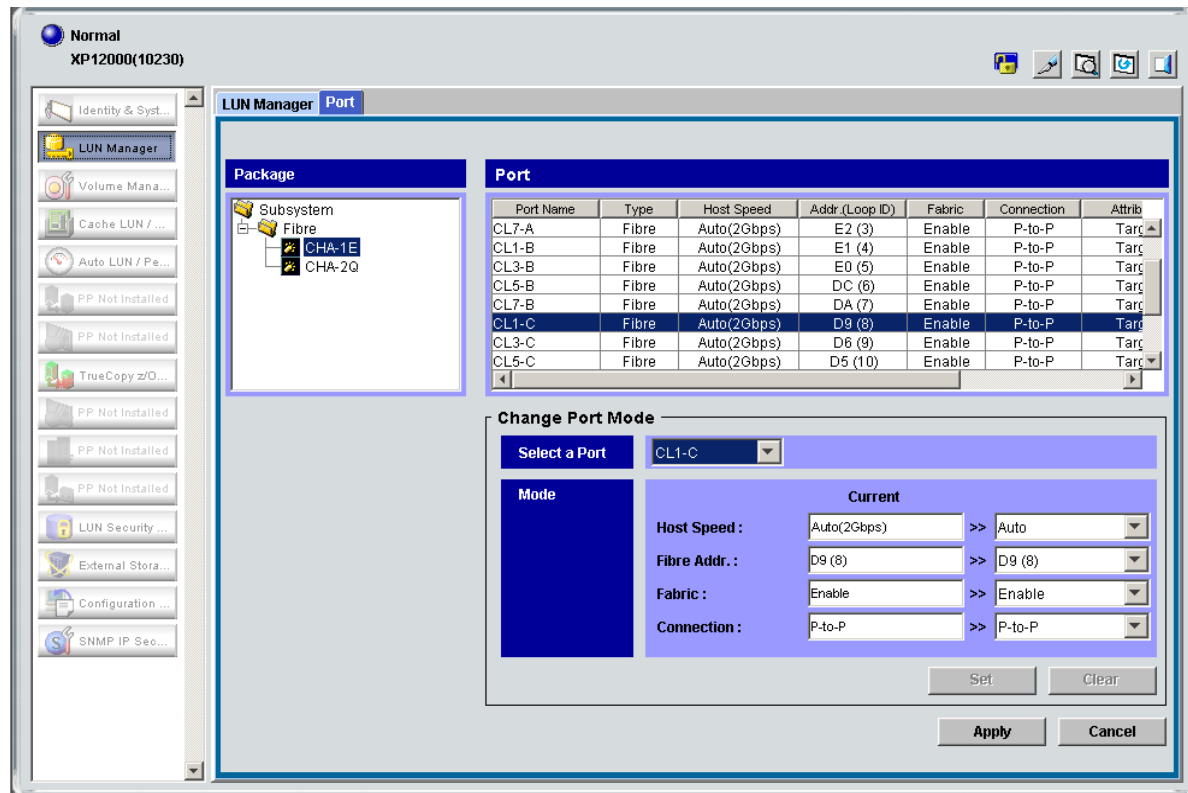
1. Log into Command View as an administrator (the default administrator user name and password is **administrator**).
2. Click **Array Manager** in the left panel and click the **Device Launcher** tab (v1.8 click the **Main** tab and **Overview** tab).



3. Click the array name in the **Device Name** column to select the array you want to access.

The array management window appears.

4. Select **LUN Manager** in the left panel (v1.8 LUN and Volume Management tab).



5. Configure the disk array Fibre Channel port connected to the VDS/VSS server(s) as follows:

Click on the **Port** tab. Choose the port from the **Select a Port** drop down menu.

Use the **Fabric** and **Connection** drop down menus to set up the port. Settings depend on how the array is connected to the servers. See the following table for the meanings of selections.

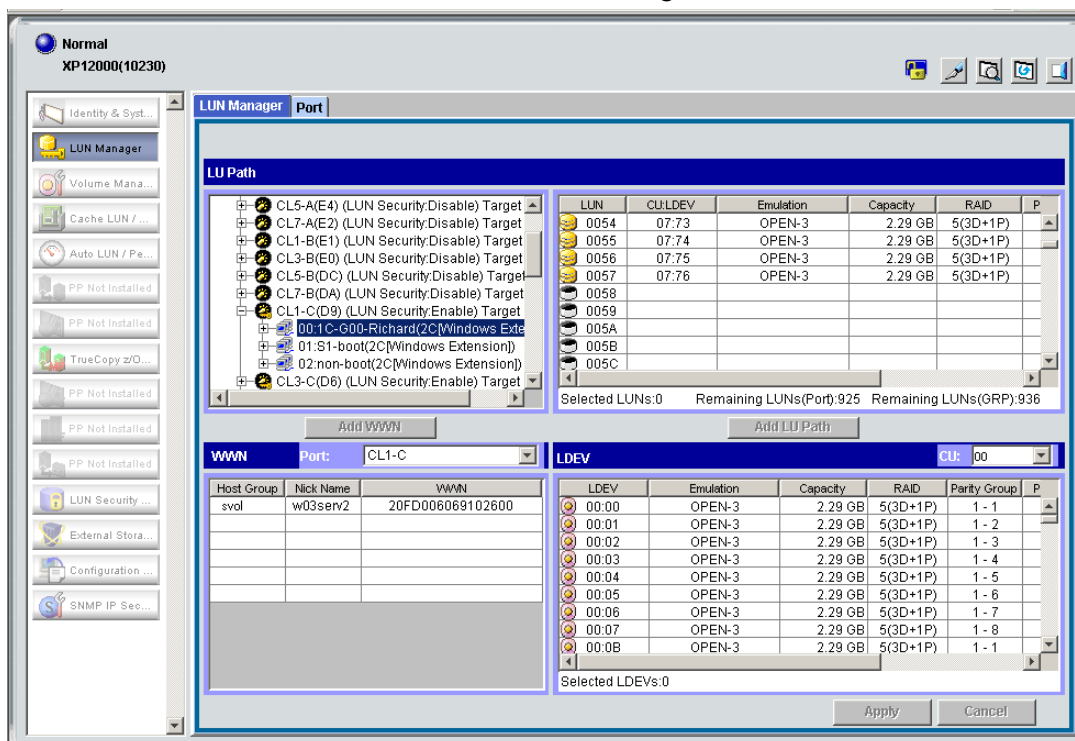
Port Fabric and Connection settings

Fabric Parameter	Connection Parameter	Provides
OFF	FC-AL	NL-port (private arbitrated loop)
ON	FC-AL	NL-port (public loop) for loop connection to a switch
ON	POINT-TO-POINT	N-port (fabric port) for connection to a switch
OFF	POINT-TO-POINT	Not supported

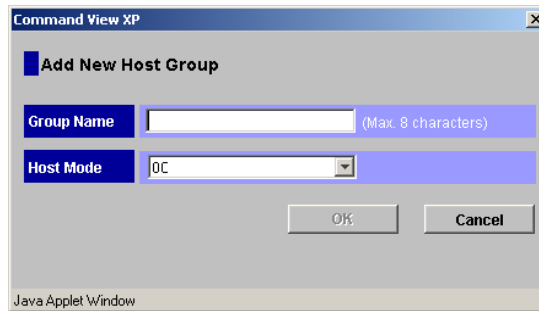
Click **Set** and a dialog pops up to confirm the change. Click **OK**. The port list above shows the Connection in italics to indicate it is pending.

Click **Apply** to confirm the port changes. A dialog asks you to confirm. Click **OK**. A completion message pops up; click **OK** again.

- Click the **LUN Manager** tab to open the LUN management window. You will use this window to configure LUNs.



7. In the LUN Manager window LU Path panel, right click on the port connected to the VDS/VSS server(s) and select **Add New Host Group**. The Add New Host Group window opens.



8. Create the host groups and set the Host Mode for the port(s) connected to the VDS/VSS server(s) and click **OK**. If you are configuring for VSS, create a host group of any name for the primary data volumes, and create a host group named **SVOL** for the secondary volumes that will store VSS data copies.

IMPORTANT: The SVOL host group should not have any host paths to it.

The **Host Mode** for Windows 2003 servers is **0C** or **2C**. Use **0C** if you want LUSE information displayed in the LUN device name. Use **2C** if you want the ability to add LUNs while online. Make sure both servers use the same mode.

9. In the LUN Manager window, turn security ON for the ports connected to the VDS/VSS server(s): Right click on the port in the LU Path tree and select **LUN Security ON**. Click **Yes** when the confirmation window appears, and click **Apply**. This applies security to the port, indicated by a key symbol on the port symbol.
10. After security has been enabled, add the VDS/VSS server HBA WWN to the primary host group **ONLY**. **Do not add any host WWNs to the SVOL host group.**

To add WWNs to a host group, in the LU Path tree, right-click the host group and then select **Add New WWN**. In the pop-up window, enter the **New WWN** and **Nickname** for the HBA of the VDS/VSS server and click **OK**.

11. In the LUN management window, create one Command Device LUN (CDEV) of at least 36 MB (larger is OK but wastes space) for each server. This LUN must be mapped to a port that is visible to the server. The CDEV LUN is used for interpreting commands and cannot be used for data.

To designate a LUN as a command device:

Right click on the LUN and select **Command Device ON**.

Command Device LUNs can be any number but are customarily assigned a number near the end of the available range. You can use a VSC volume for a Command Device, but do not use a LUSE volume.

12. In the LUN management window, create primary and secondary LUNs within the primary and SVOL host groups, respectively.

To add a LUN:

Click the LUN you wish to define in the right panel. Select an LDEV in the lower right panel. Then click **Add LU Path**. A confirmation dialog pops up; click **OK** and the LUN is added with a path to the selected LDEV. Click **Apply** to confirm the added LUN.

The primary and secondary LUNs must be the same emulation type (OPEN-3, OPEN-9 etc.) and the same size in GB. You must create at least an equal number of primary and secondary LUNs so there are enough secondary LUNs to hold the primary LUN copies. Some applications may require twice as many or more secondary LUNs as primary LUNs.

Windows limits LUNs to the range of 00 to FE, so be sure not to use a LUN number above FE.

Windows 2000 requires a LUN 0 in order for LUNs greater than 7 to be recognized by the OS. Windows 2003 with SCSI Port Miniport Driver requires a LUN 0 in order to recognize any additional LUNs.

Installation

This chapter explains how to install the HP Hardware Providers (HWP) and other required software. When you install HP HWP, the features of VDS and VSS are enabled, including point-in-time copies of LUNs and storage virtualization management. Follow all configuration and installation instructions carefully.

IMPORTANT NOTE: The right combination of software versions is crucial to configuring a working system. Refer to the *HP StorageWorks Hardware Providers Supported Configurations* document and any README files accompanying the HP HWP installation files for information about compatible software versions and system configurations.

For HP Hardware Providers documentation and software downloads, see the following web location:

www.hp.com/support/vssvdshwp

Installation procedures

The following procedures describe how to install the RAID Manager Libraries and the HP Hardware Providers.

If you have not already configured the server and the array as instructed in [Chapter 2 Configuration](#), do so now before you install the HP HWP software. HP HWP will not work if the array and server have not been correctly configured before you install HP HWP. For a summary of the configuration steps, see [“Configuration summary” on page 30](#).

Installation summary

You will perform the following tasks during installation:

RAID Manager Library:

- Run **setup.exe** in the Windows/RMLIB folder.
- Follow the InstallShield Wizard instructions to select a destination for the library and install it.

Hardware Providers:

- Run the HP HWP installation executables:
hp StorageWorks VDS hardware provider for XP.msi
or
hp StorageWorks VSS hardware provider for XP.msi.
- Follow the InstallShield Wizard instructions to do the following tasks.
- Enter the CV IP address and log into Command View.
- Configure HP HWP with the list of arrays managed by Command View.
- Retrieve the disk number of the Command Device LUN.
- Configure the Business Copy LUNs for volume shadow copies (if you install VSS).

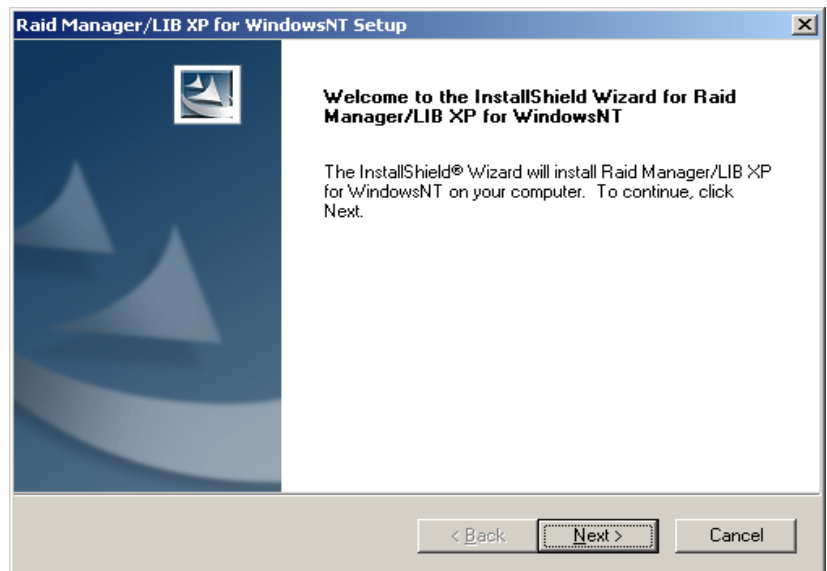
Installing RAID Manager Library

The RAID Manager Library is required on the server(s) for VSS only to enable Business Copy operations on the disk array. Note that the Business Copy array firmware license and the Business Copy license key in Command View must be installed for VSS to work.

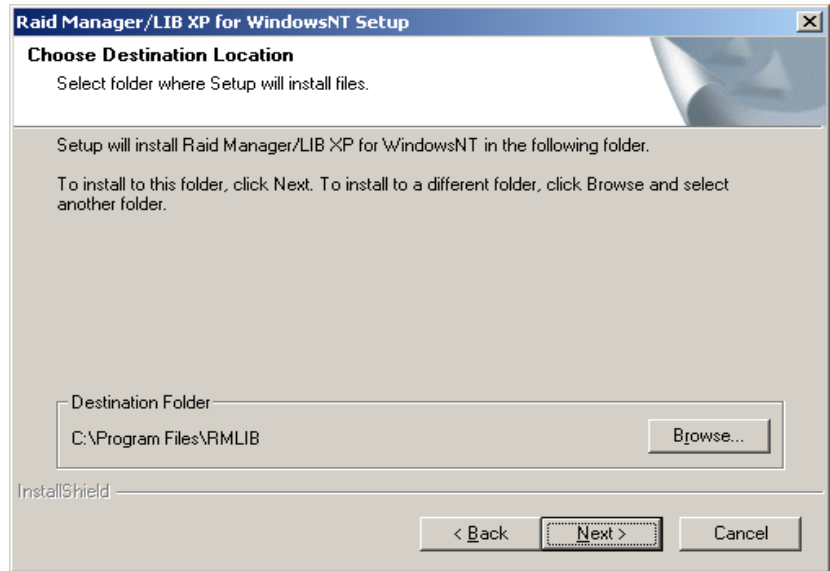
Install the RAID Manager Library on the VDS/VSS server. For detailed installation instructions, see the *RAID Manager Library Installation Guide*. A summary of installation is presented below.

1. Access the RAID Manager Library installation CD on the host.
2. Open the Windows folder, the RMLIB folder, and double click the **setup.exe** file to start the RM installation executable.

The InstallShield Welcome window appears.



3. Click **Next**, and the Choose Destination Location window appears.

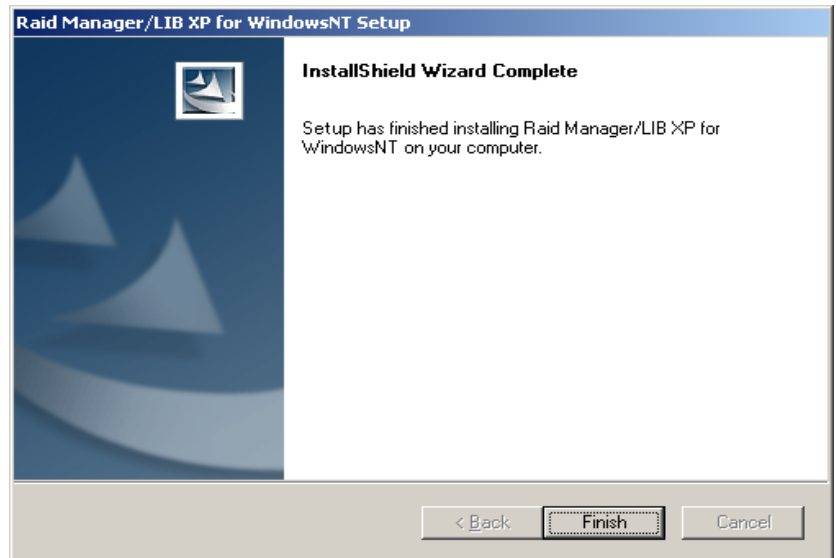


4. Click **Next** to select the default Destination Folder shown, or click **Browse** to select a different location for installing the software, and then click **Next**.

The software begins installing, and a window opens to show progress.

5. Click **Next** in the progress Window when the progress meter shows that installation is done.

6. When installation is complete, the InstallShield Wizard Complete window appears.



7. Select **Finish** to exit the installer.

Installing HP HWP

The Hardware Providers installation utility does the following:

- Installs the HP VSS or VDS HWP (each has a separate executable)
- Allows you to log into Command View.
- Configures HP HWP with a list of arrays managed by Command View.
- Retrieves the disk number of the Command Device LUN (for VSS).
- Configures the Business Copy (SVOL) LUNs. These secondary LUNs will hold the volume shadow copies (for VSS).

To install VDS or VSS:

Installation for VDS and VSS uses the same configuration utility and is nearly identical; therefore only VSS installation is described. However, each package must be installed individually. You do not need to install both if you do not plan to use them both. Just install the one you want.

1. Insert the HP HWP installation CD or download the software from the HP website. Double click the executable file:

hp StorageWorks VDS hardware provider for XP.msi

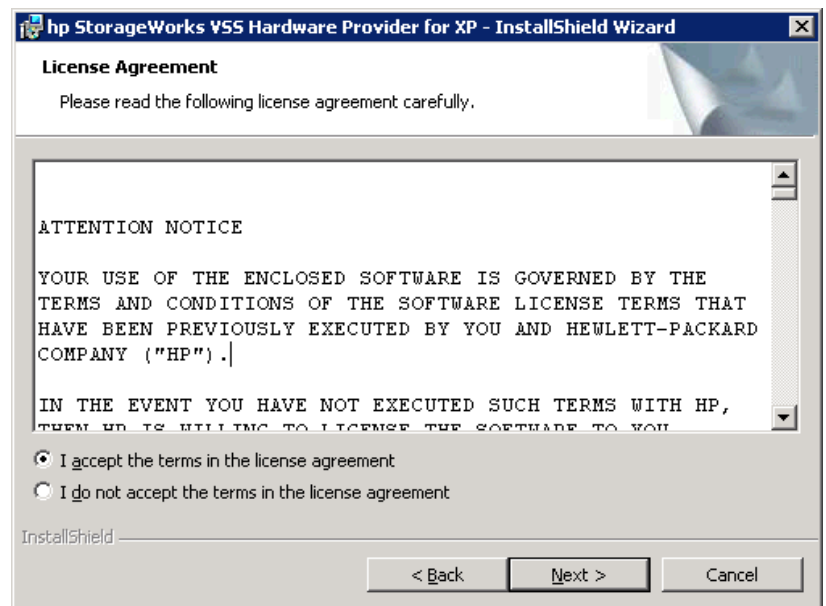
or

hp StorageWorks VSS hardware provider for XP.msi

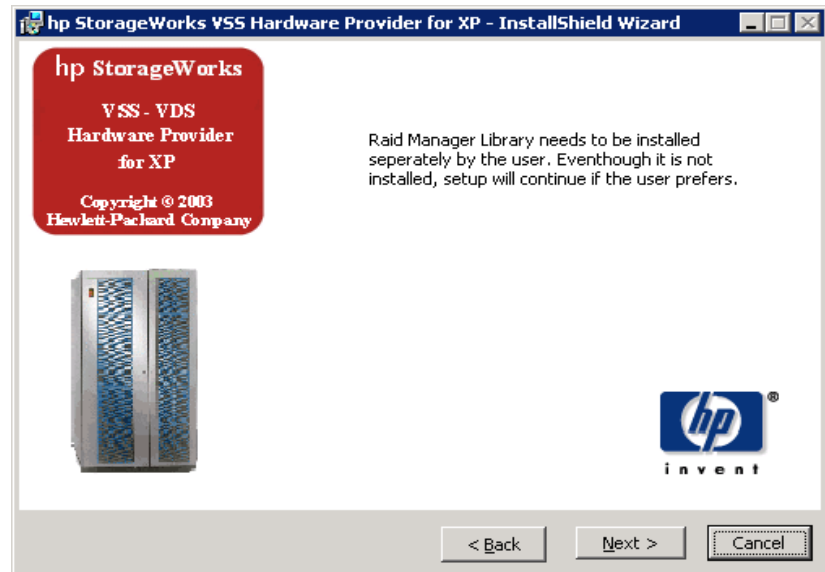
The InstallShield Welcome window appears.



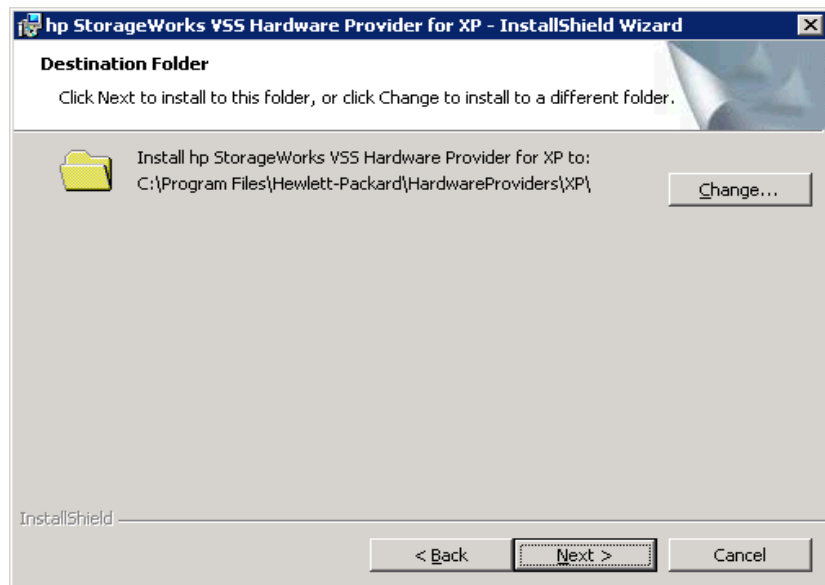
2. Click **Next**. The License Agreement window appears.



3. Click **“I accept...”** to agree to the license terms, and click **Next**. If RAID Manager Library is not installed, a warning appears. You can continue HWP installation even if RMLib is not installed and install RMLib later.

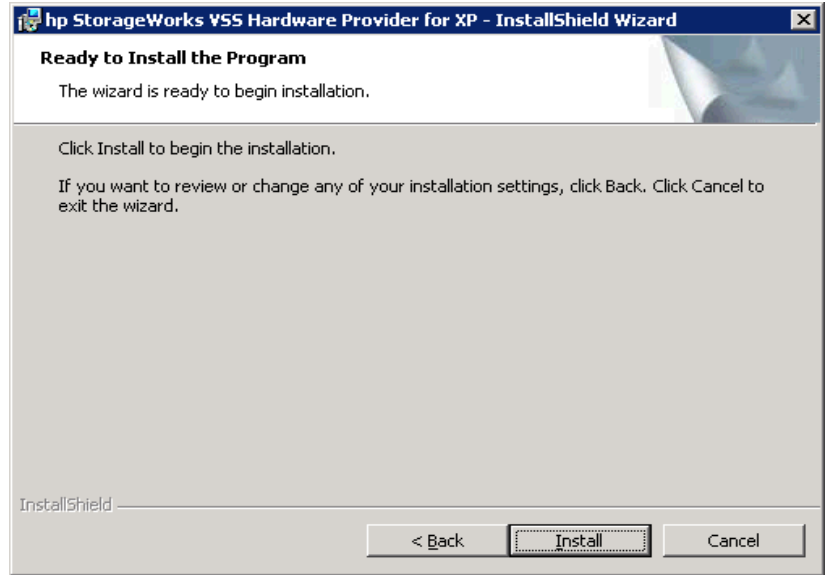


4. Click **Next**. The Destination Folder window appears.

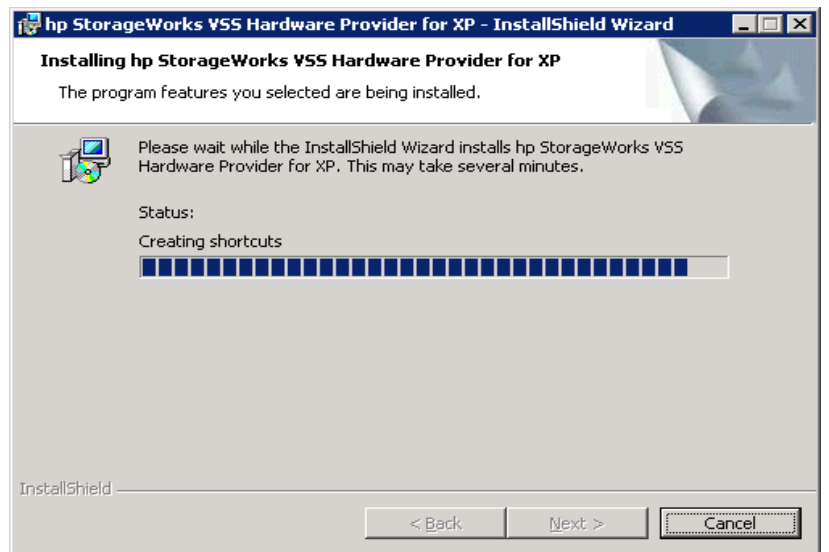


5. Click **Next** to install VDS/VSS in the default location, or click **Change** to browse for a new location, and then click **Next**.

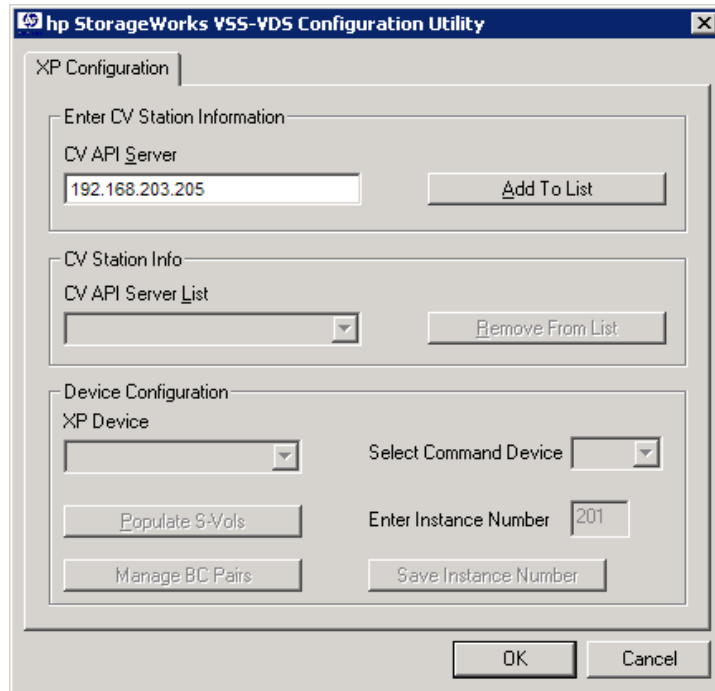
The Ready to Install window appears.



6. Click **Install** to start the installation process. A status window appears to show progress.



7. When installation finishes, the VSS-VDS Configuration Utility opens.

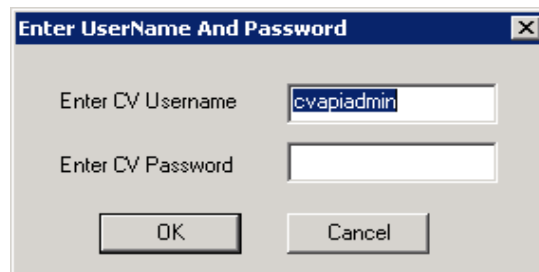


The image shows the 'hp StorageWorks VSS-VDS Configuration Utility' dialog box. It has a title bar with the HP logo and the text 'hp StorageWorks VSS-VDS Configuration Utility'. The dialog is divided into three main sections: 'XP Configuration', 'CV Station Info', and 'Device Configuration'. In the 'XP Configuration' section, there is a text box labeled 'Enter CV Station Information' with the IP address '192.168.203.205' entered, and an 'Add To List' button. In the 'CV Station Info' section, there is a dropdown menu labeled 'CV API Server List' and a 'Remove From List' button. In the 'Device Configuration' section, there are two dropdown menus: 'XP Device' and 'Select Command Device'. Below these are four buttons: 'Populate S-Vols', 'Manage BC Pairs', 'Enter Instance Number' (with the value '201' entered), and 'Save Instance Number'. At the bottom right of the dialog are 'OK' and 'Cancel' buttons.

Configuring VSS/VDS to access Command View:

8. In the Enter CV Station Information text box, enter the IP address of the Command View workstation and click **Add To List**.

The Enter UserName and Password window pops up.



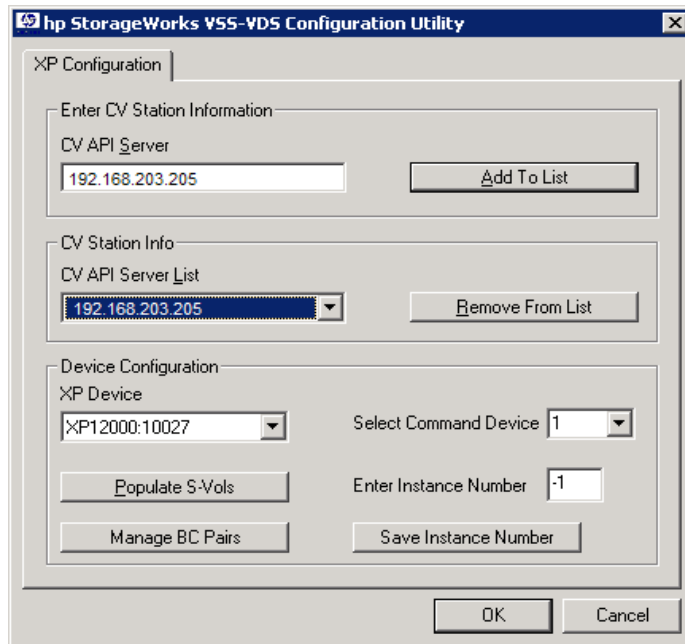
The image shows the 'Enter UserName And Password' dialog box. It has a title bar with the text 'Enter UserName And Password'. The dialog contains two text boxes: 'Enter CV Username' with the value 'cvapiadmin' entered, and 'Enter CV Password' which is empty. At the bottom are 'OK' and 'Cancel' buttons.

9. Enter the Command View user name: **cvapiadmin**.

Enter the CV password: **nimdaipavc** (the user name backwards).

Click **OK**.

The Configuration Utility connects to the CV station and retrieves CV station information. While it is connecting to CV, a “wait” message appears. When connected to CV, the utility window looks like this:



The window is automatically populated with the list of disk arrays managed by the CommandView server.

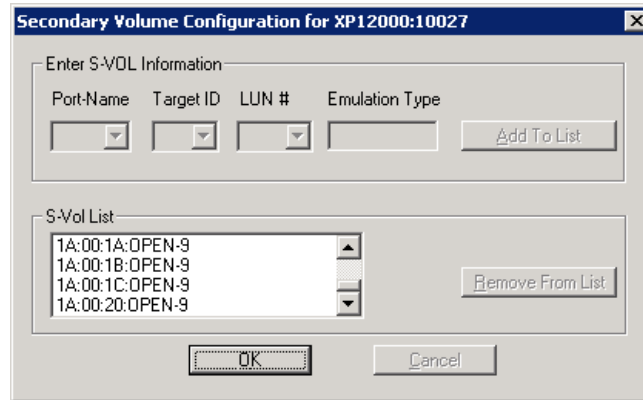
If the window is not populated, a communication problem has occurred at the CommandView server. Check CV station connectivity. Make sure the LAN that connects CV to the VDS/VSS HWP server has priority in CV station NIC binding. Also make sure a firewall does not separate the CV server from the SVP or servers.

10. Select the XP Device and Command Device using the drop down menus in the Device Configuration section. (If you change the selections, they do not take effect until you click **OK** later in this procedure.)

Creating the list of SVOLs (required for VSS only):

11. Click **Populate SVOLs** to create a list of SVOLs (secondary volumes) for storing VSS data copies.

The Secondary Volume Configuration window opens listing the available volumes.



12. Verify that the SVOL list is correct.

If the list of SVOLs is incorrect, the SVOL list from the CV server may need to be refreshed. On the CV server stop and restart the VDS/VSS services by clicking **Start > Programs > HP StorageWorks > Stop/Start Services**. Then click **Populate SVOLs** again. If the list still does not refresh, reboot the CV server.

If no SVOLs are listed at all, make sure you created a host group named **SVOL** and created secondary volumes when you configured the array using Command View.

Note that the **Add To List** button does not work in this version of the configuration utility.

13. Click **OK** in the SVOL window when the SVOL list is correct.

Assigning an instance number to the configuration:

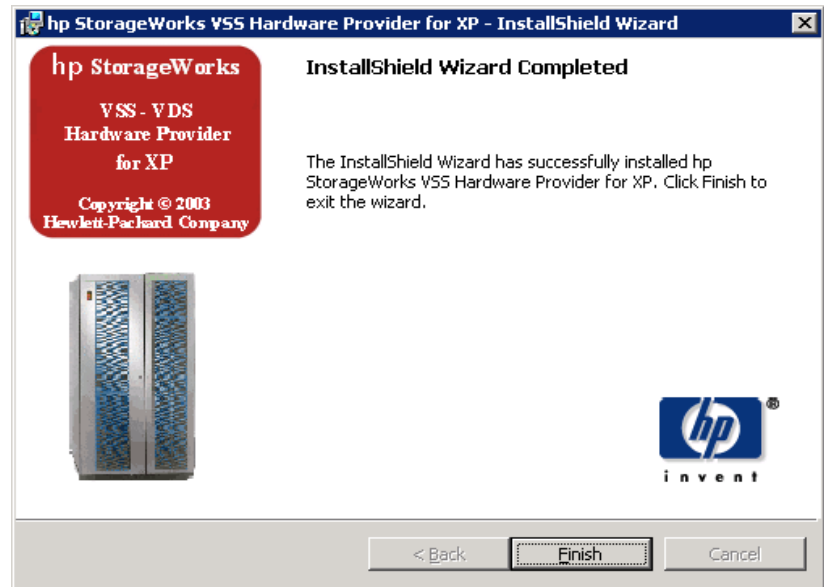
Save this particular VSS/VDS configuration by assigning it an instance number.

14. Select a number in the range of 201 to 1000 and enter it in the **Enter Instance Number** box. This number **must** be between 201 and 1000, and it must be different for each HWP server. The Instance Number is persistent until updated on this screen.

The screenshot shows the 'hp StorageWorks VSS-VDS Configuration Utility' dialog box. It has a tabbed interface with 'XP Configuration' selected. The dialog is divided into three main sections: 'Enter CV Station Information', 'CV Station Info', and 'Device Configuration'. In the 'Enter CV Station Information' section, the 'CV API Server' text box contains '192.168.203.205' and there is an 'Add To List' button. In the 'CV Station Info' section, the 'CV API Server List' dropdown menu also shows '192.168.203.205' and there is a 'Remove From List' button. In the 'Device Configuration' section, the 'XP Device' dropdown menu shows 'XP12000:10027', the 'Select Command Device' dropdown menu shows '1', and the 'Enter Instance Number' text box contains '201'. There are also buttons for 'Populate S-Vols', 'Manage BC Pairs', and 'Save Instance Number'. At the bottom right of the dialog are 'OK' and 'Cancel' buttons.

15. Click **Save Instance Number**. (The instance number is not saved until you click **Save Instance Number** AND click **OK** in the following step.)

16. Click **OK**. The Configuration Utility closes, and the InstallShield Wizard Completed window appears. (If you need to open the Configuration Utility again, select the following path:
Start > Programs > Hewlett-Packard > Hardware Providers > Provider Configuration for hp-XP.)



17. Click **Finish**.
18. HWP installation is now complete. If all other applications have been installed, this is a good time to install the Microsoft QFEs (quick fixes) from the Microsoft website. The QFEs are required to fix problems in the Microsoft OS that have not yet been released in a service pack. For information about QFEs that are currently needed for HWP, see the **HWP Readme** file.

Verifying installation

To verify installation, perform the following tests. If you have any trouble with installation or with verifying installation, see Chapter 4 “Troubleshooting” in this guide.

Checking visibility of the disk array

If you configured the disk array and server properly, the array LUNs should be visible in the Disk Management window on the VDS/VSS server. Click the Windows **Start** menu, click **Administrative Tools**, click **Computer Management** and click **Disk Management**. You should see the array LUNs listed.

Checking the list of programs in Windows

A simple way to verify successful installation of the HP HWPs is to make sure they are listed in the Add/Remove Programs Control Panel in Windows. To see the list of installed programs, click Windows **Start**, click **Settings**, click **Control Panel**, and double-click **Add/Remove Programs**. Verify the HP VDS/VSS HWPs appear in the list of installed programs.

Checking VDS disk management using DiskRaid

The Microsoft DiskRaid command line interface requires the HP VDS HWP in order to work with the HP disk array. You can install and run DiskRaid and use the “list provider” and “list subsystem” commands to verify the HP HWP is working properly:

```
DISKRAID> List Provider
```

Prov ###	Name	Version
* Prov 0	hpXP VDS Hardware Provider	2.7.2.0

```
DISKRAID> list subsystem
```

Subsys ###	Name	Status	Health
Subsys 0	HP XP 12000 (SN# 10230)	Online	Healthy

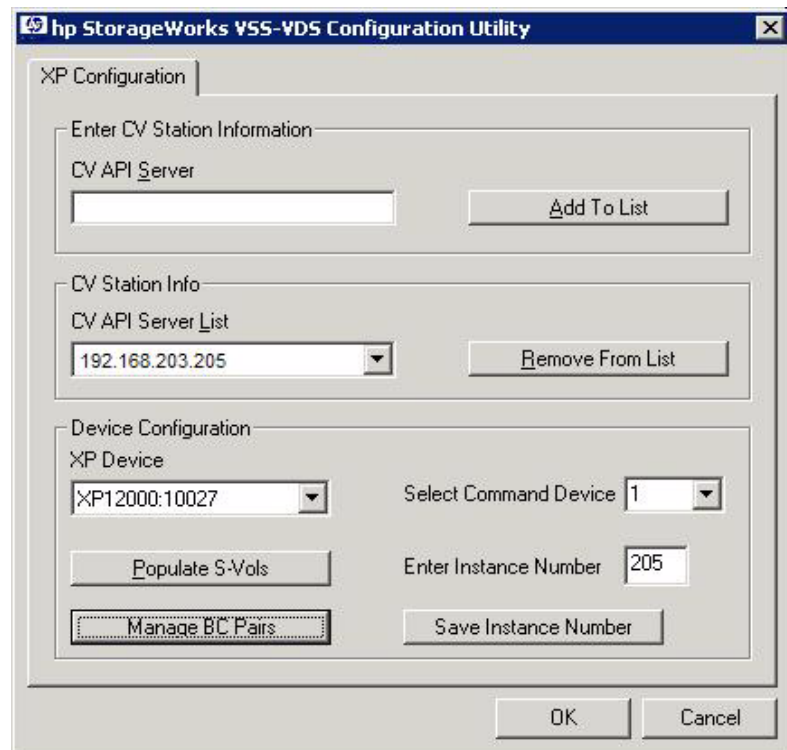
Checking VSS volume shadow copying

Testing the HP VSS HWP requires a third party application that can work with VSS, the HP VSS HWP, and disk array to create hardware volume shadow copies. Test the HWP installation by making a shadow copy using the third party application. Then check for the presence of the data copy on the SVOL you designated for copying. If the copy is not successful, see Chapter 4 Troubleshooting.

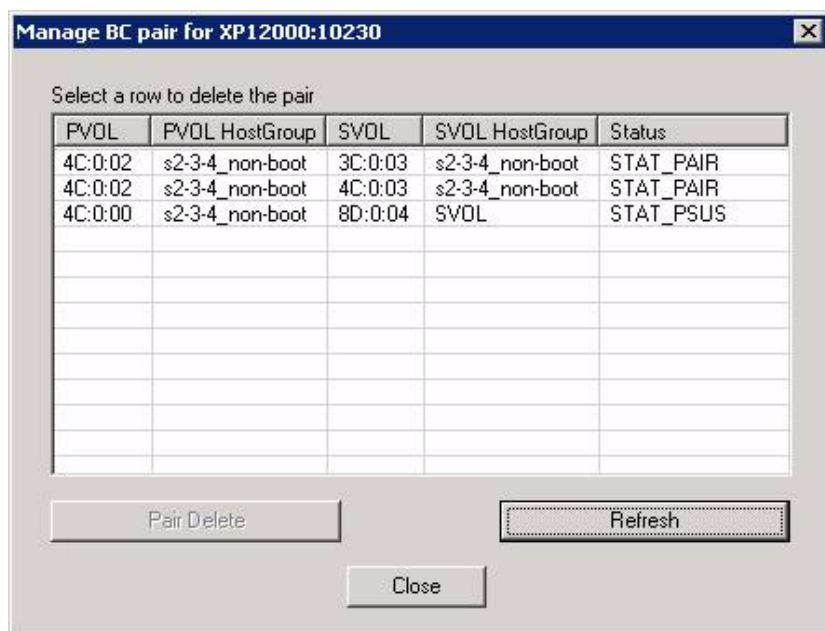
Checking copy pairs using the HP HWP Configuration Utility

You can monitor operation of HWP by viewing the copy pairs (PVOLs and SVOLs) using the HP HWP Configuration Utility.

1. Launch the utility using the following path:
Start > Programs > Hewlett-Packard > Hardware Providers > Provider Configuration for hp-XP. The utility opens.



2. If necessary, select the correct CV server, disk array, and command device in the utility window, and then click **Manage BC Pairs**. The Manage BC pair window appears.



The data in the columns of this window have the following meanings:

PVOL: Lists primary volumes on the array. The syntax is port, control unit, LUN number:

Port 4C is the port on the array

0: is the Control Unit

02 is the LUN number

PVOL HostGroup: The name of the primary host group provided by the storage administrator.

SVOL: Lists secondary volumes on the array. The syntax is the same as for PVOL.

SVOL HostGroup: The required name of the secondary host group.

Status: State of the BC pair.

The first two lines of the preceding example show a Business Copy pair created using Command View with two paths. The PVOL appears

on port 4C, and the SVOL appears on ports 3C and 4C. The third line shows a VSS-created pair in the PSUS state (pair split) with the SVOL in the SVOL host group and not visible or mounted by any server.

The pair split state is a Business Copy term meaning the SVOL copy has been created and split from the PVOL, essentially making it a split mirror. See the *HP StorageWorks XP Business Copy User Guide* for more information about BC terminology and how the software works.

You can delete a pair, making them no longer paired, by clicking on a pair and clicking **Pair Delete**. To refresh the list of pairs, click **Refresh**.

3. When finished using the utility, click **Close** to exit.

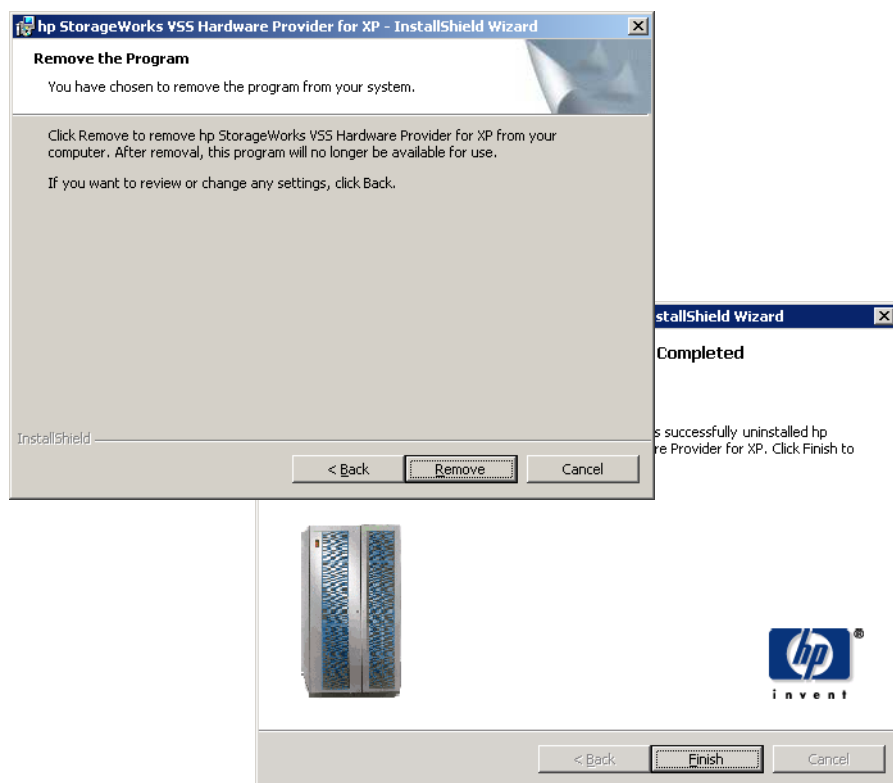
Uninstalling HP HWP

Uninstalling HP HWP using Windows

1. In Windows, select **Start > Settings > Control Panel**.
2. Double-click **Add/Remove Programs**.
3. Select the program you want to remove (HP VDS or VSS HWP).
4. Click **Change/Remove**. Windows removes the program.

Uninstalling using HP HWP Installer

You can also uninstall HP HWP by starting the HP HWP installer again. Click **Remove** to start removal. When removal is complete, click **Finish**.



Troubleshooting

This chapter explains how to troubleshoot Hardware Providers (HWP) and also presents a list of VDS and VSS error messages and explanations.

Troubleshooting

The following instructions present typical problems and solutions.

VDS/VSS HWP will not install

The HP HWP installation works only on the Windows versions listed in the README file supplied with the HP HWP. The installer will not install the software on other versions of Windows.

VDS disk array management not working

Use a process of elimination to determine whether the problem is with one of the following components:

- Application managing the array
- VDS
- HP HWP

Perform these tests:

1. Do the array volumes appear in the Disk Management tool? To check, in the Windows menu bar select **Start > Control Panels > Administrative Tools > Computer Management > Storage > Disk Management**. If array LUNs are not visible, click **Action > Refresh** and **Action > Scan Disks**. If array LUNs are visible, Windows has recognized the array drives through VDS and HP HWP. The problem may be with your software application. If LUNs are still not visible, try the next test.
2. Use the DiskPart utility to check for the presence of array volumes. At the Run command line, type **diskpart.exe**. Type **list disk** to see a list of disk devices present. (Type “help” to see a list of commands.) If array

disks are listed, the array is visible through VDS and HP HWP. The problem may be with your software application. If array disks are not listed, there may be a problem with configuration or VDS HP HWP.

If you receive this error message: “**The disk management services could not complete the operation,**” VDS is not enabled at startup. Follow these steps to enable VDS at startup:

Click **Start**

Click **Control Panels**

Click **Administrative Tools**

Click **Services**

Right-click **Virtual Disk Service**

Click **Properties**

Click **Manual** under **Startup type**

Click **OK**

3. Check the README file that came with your HP HWP installation files to verify you are using compatible versions of software.
4. Make sure you configured the VDS/VSS Configuration Utility as explained in Chapter 3 Installation.
5. Check configuration as explained in Chapter 2 Configuration:
 - (A) Check LAN connectivity between all servers and the array.
 - (B) Make sure the firewall is open between all servers and the array.
 - (C) Check Command View server NIC bindings: the LAN that connects to the VDS/VSS server must be listed first in the Windows **Network Connections/Advanced Settings/Adapters and Bindings** display.
 - (D) Make sure you logged into all devices and software using administrator privileges.
6. Visit the Microsoft website support knowledge base and search for “VDS logging.” Turn on logging as instructed by Microsoft and use the Microsoft procedure for testing VDS and checking the log.

VSS volume copying not working

1. Verify that Business Copy is licensed in Command View and RAID Manager Library is installed on all VDS/VSS servers. BC and RMLib are required in order to copy LUNs using VSS.
2. Make sure you configured the VDS/VSS Utility as explained in Chapter 3 Installation.
3. Check configuration as explained in Chapter 2 Configuration:
 - (A) Check Command View server and VDS/VSS server connectivity.
 - (B) VDS/VSS server not connected to the SAN correctly.
 - (C) Firewall exists between the Command View and VDS/VSS server.
 - (E) Check Command View server NIC bindings: the LAN that connects to the VDS/VSS server must be listed first in the Windows **Network Connections/Advanced Settings/Adapters and Bindings** display.
 - (F) Check that a host group named **SVOL** exists with secondary LUNs that match the parameters of the primary LUNs (same volume type and size). No host WWNs should be associated with the SVOL before installation.
4. Review the Windows application event log, Windows system event log, and VSS trace to locate errors in the snapshot process. See the Microsoft website and Windows help for information about the log and trace files.
5. Use a process of elimination to determine which components are not working. You can do this by testing components individually:
 - Test VSS by creating a shadow copy on a local drive using the Windows Disk Management/Shadow Copy feature. See Windows Help for instructions.
 - Test your backup application and VSS together by making a backup copy on a local drive, bypassing HWP and the disk array.
 - Test array copy capability by using Business Copy to create PVOL and SVOL pairs and copy the PVOL to the SVOL. See the *HP StorageWorks Business Copy User Guide* for instructions.
 - If any tests fail, that component may be the problem. If all tests succeed, HWP may be the problem.

VSS copies intermittently fail or time out

VSS allows only 30 seconds for the entire snapshot process, including only 10 seconds for actually making the copy. This narrow time window can cause any limitation in your system to hamper successful snapshots. The following issues may affect system performance:

- Firewall or LAN traffic slowing or preventing communication. Reconfigure the firewall or LAN to increase throughput.
- Viruses slowing server operation. Check for and clean off viruses.
- VDS/VSS server is too slow. Use a fast, late mode CPU with sufficient memory.
- Inadequate privileges. Administrator privileges are required in all applications and on all hardware used with HP VSS HWP.
- Writer application not configured according to best practices. Consult the software manufacturer for recommended practices. For example, keeping database files small by creating more rather than larger files may speed up overall operation and database copying. Saving transaction logs to a different volume than the database may also speed up performance.
- Review the Windows application event log, Windows system event log, and VSS trace to locate errors in the snapshot process. See the Microsoft website and Windows Help regarding log and trace files.

Error messages

The following tables list error messages and their meanings.

VDS error messages

Message Id	MessageID Value (hex)	Message Text
VDS_E_NOT_SUPPORTED	0x80042400L	The operation is not supported by the object.
VDS_E_INITIALIZED_FAILED	0x80042401L	The service failed to initialize.
VDS_E_INITIALIZE_NOT_CALLED	0x80042402L	The initialization method is not called.
VDS_E_ALREADY_REGISTERED	0x80042403L	The provider is already registered.
VDS_E_ANOTHER_CALL_IN_PROGRESS	0x80042404L	A concurrent second call is made on an object before the first is completed.
VDS_E_OBJECT_NOT_FOUND	0x80042405L	The object is not found.
VDS_E_INVALID_SPACE	0x80042406L	The specified space is not free or not valid.
VDS_E_PARTITION_LIMIT_REACHED	0x80042407L	Number of partitions has reached the limit on a disk.
VDS_E_PARTITION_NOT_EMPTY	0x80042408L	The extended partition is not empty.
VDS_E_OPERATION_PENDING	0x80042409L	The operation has not been completed yet.
VDS_E_OPERATION_DENIED	0x8004240AL	This operation is not allowed on the current boot, system or page file volume.
VDS_E_OBJECT_DELETED	0x8004240BL	The object has been deleted.
VDS_E_CANCEL_TOO_LATE	0x8004240CL	The operation cannot be cancelled because it is too late.
VDS_E_OPERATION_CANCELED	0x8004240DL	The operation has been cancelled.
VDS_E_CANNOT_EXTEND	0x8004240EL	The volume cannot be extended because the file system does not support it.
VDS_E_NOT_ENOUGH_SPACE	0x8004240FL	There is not enough usable space for this operation.

VDS_E_NOT_ENOUGH_DRIVE	0x80042410L	Not enough drives are specified to complete this operation.
VDS_E_BAD_COOKIE	0x80042411L	The cookie is not found.
VDS_E_NO_MEDIA	0x80042412L	There is no media in the device.
VDS_E_DEVICE_IN_USE	0x80042413L	The device is in use.
VDS_E_DISK_NOT_EMPTY	0x80042414L	The disk is not empty.
VDS_E_INVALID_OPERATION	0x80042415L	Invalid operation.
VDS_E_PATH_NOT_FOUND	0x80042416L	The path is not found.
VDS_E_DISK_NOT_INITIALIZED	0x80042417L	The disk is not initialized.
VDS_E_NOT_AN_UNALLOCATED_DISK	0x80042418L	The disk is not unallocated.
VDS_E_UNRECOVERABLE_ERROR	0x80042419L	Unrecoverable error happened. The service must shut down.
VDS_S_DISK_PARTIALLY_CLEANED	0x0004241AL	The disk is not fully cleaned due to I/O error.
VDS_E_DMADMIN_SERVICE_CONNECTION_FAILED	0x8004241BL	The provider failed to connect to the Logical Disk Management Administrative service.
VDS_E_PROVIDER_INITIALIZATION_FAILED	0x8004241CL	The provider failed to initialize.
VDS_E_OBJECT_EXISTS	0x8004241DL	The object already exists.
VDS_E_NO_DISKS_FOUND	0x8004241EL	No disks were found on the target machine.
VDS_E_PROVIDER_CACHE_CORRUPT	0x8004241FL	The provider's cache has become corrupt.
VDS_E_DMADMIN_METHOD_CALL_FAILED	0x80042420L	A method call to the Logical Disk Management Administrative service failed.
VDS_S_PROVIDER_ERROR_LOADING_CACHE	0x00042421L	The provider encountered errors while loading the cache. See the NT Event Log for more information.
VDS_E_PROVIDER_VOL_DEVICE_NAME_NOT_FOUND	0x80042422L	The device form of the volume pathname could not be retrieved.
VDS_E_PROVIDER_VOL_OPEN	0x80042423L	Failed to open the volume device.
VDS_E_DMADMIN_CORRUPT_NOTIFICATION	0x80042424L	A corrupt notification was sent from the Logical Disk Manager Administrative service.
VDS_E_INCOMPATIBLE_FILE_SYSTEM	0x80042425L	The file system is incompatible.

VDS_E_INCOMPATIBLE_MEDIA	0x80042426L	The media is incompatible.
VDS_E_ACCESS_DENIED	0x80042427L	Access is denied.
VDS_E_MEDIA_WRITE_PROTECTED	0x80042428L	The media is write protected.
HRESULT VDS_E_BAD_LABEL	0x80042429L	The label is illegal.
VDS_E_CANT_QUICK_FORMAT	0x8004242AL	Can not quick format the volume.
VDS_E_IO_ERROR	0x8004242BL	IO error occurred during format.
VDS_E_VOLUME_TOO_SMALL	0x8004242CL	The volume size is too small.
VDS_E_VOLUME_TOO_BIG	0x8004242DL	The volume size is too big.
VDS_E_CLUSTER_SIZE_TOO_SMALL	0x8004242EL	The cluster size is too small.
VDS_E_CLUSTER_SIZE_TOO_BIG	0x8004242FL	The cluster size is too big.
VDS_E_CLUSTER_COUNT_BEYOND_32BITS	0x80042430L	The number of clusters is too big for 32 bit integer.
VDS_E_OBJECT_STATUS_	0x80042431L	The object is in failed status.
VDS_E_VOLUME_INCOMPLETE	0x80042432L	All extents for the volume could not be found.
VDS_E_EXTENT_SIZE_LESS_THAN_MIN	0x80042433L	The size of the extent is less than the minimum.
VDS_S_UPDATE_BOOTFILE_FAILED	0x00042434L	Failed to update the boot.ini file or NVRAM.
VDS_S_BOOT_PARTITION_NUMBER_CHANGE	0x00042436L	The boot partition's partition number will change as a result of the migration operation.
VDS_E_BOOT_PARTITION_NUMBER_CHANGE	0x80042436L	The migration operation failed. The boot partition's partition number will change as a result of the migration operation.
VDS_E_NO_FREE_SPACE	0x80042437L	The migration operation failed. The selected disk does not have enough free space to complete the operation.
VDS_E_ACTIVE_PARTITION	0x80042438L	The migration operation failed. An active partition was detected on the selected disk, and it is not the active partition used to boot the currently running OS.
VDS_E_PARTITION_OF_UNKNOWN_TYPE	0x80042439L	The migration operation failed. Cannot read partition information.

VDS_E_LEGACY_VOLUME_FORMAT	0x8004243AL	The migration operation failed. A partition with an unknown type was detected on the selected disk.
VDS_E_NON_CONTIGUOUS_DATA_PARTITIONS	0x8004243BL	The migration operation failed. The selected GPT formatted disk contains a non-basic-data partition, which is both preceded, and followed, by a basic data partition(s).
VDS_E_MIGRATE_OPEN_VOLUME	0x8004243CL	The migration operation failed. A volume on the selected disk could not be opened.
VDS_E_VOLUME_NOT_ONLINE	0x8004243DL	Operation failed. The volume is not online
VDS_E_VOLUME_NOT_HEALTHY	0x8004243EL	Operation failed. The volume is not healthy.
VDS_E_VOLUME_SPANS_DISKS	0x8004243FL	Operation failed. The volume spans multiple disks.
VDS_E_REQUIRES_CONTIGUOUS_DISK_SPACE	0x80042440L	Operation failed. The volume consists of multiple extents.
VDS_E_BAD_PROVIDER_DATA	0x80042441L	A provider returned bad data.
VDS_E_PROVIDER_FAILURE	0x80042442L	A provider failed to complete an operation.
VDS_S_VOLUME_COMPRESS_FAILED	0x00042443L	Failed to compress the volume.
VDS_E_PACK_OFFLINE	0x80042444L	The operation failed. The pack is not online.
VDS_E_VOLUME_NOT_A_MIRROR	0x80042445L	Break or remove plex operation failed. The volume is not a mirror.
VDS_E_NO_EXTENTS_FOR_VOLUME	0x80042446L	No extents were found for the volume.
VDS_E_DISK_NOT_LOADED_TO_CACHE	0x80042447L	The migrated disk failed to load to the cache.
VDS_E_INTERNAL_ERROR	0x80042448L	Check the event log for errors.
VDS_S_ACCESS_PATH_NOT_DELETED	0x00042449L	The access paths on the volume may not be deleted.
VDS_E_PROVIDER_TYPE_NOT_SUPPORTED	0x8004244AL	The method call is not supported for the specified provider type.
VDS_E_DISK_NOT_ONLINE	0x8004244BL	The repair operation failed. The disk is already in use by the volume.
VDS_S_IN_PROGRESS	0x0004244DL	The asynchronous operation is in progress.
VDS_E_ASYNC_OBJECT_FAILURE	0x8004244EL	Failure initializing the asynchronous object.

VDS_E_VOLUME_NOT_MOUNTED	0x8004244FL	The volume is not mounted.
VDS_E_PACK_NOT_FOUND	0x80042450L	The pack was not found.
VDS_E_IMPORT_SET_INCOMPLETE	0x80042451L	Import failed. Attempt to import a subset of the disks in the foreign pack.
VDS_E_DISK_NOT_IMPORTED	0x80042452L	A disk in the import's source pack was not imported.
VDS_E_OBJECT_OUT_OF_SYNC	0x80042453L	The system's information about the object may not be up to date.
VDS_E_MISSING_	0x80042454L	Operation failed. The disk is missing.
VDS_E_DISK_PNP_REG_CORRUPT	0x80042455L	The provider's list of Pnp registered disks has become corrupt.
VDS_E_LBN_REMAP_ENABLED_FLAG	0x80042456L	The provider does not support the LBN REMAP ENABLED volume flag.
VDS_E_NO_DRIVELETTER_FLAG	0x80042457L	The provider does not support the NO DRIVELETTER volume flag.
VDS_E_REVERT_ON_CLOSE	0x80042458L	REVERT ON CLOSE should only be set if the HIDDEN or READ ONLY volume flag is set.
VDS_E_REVERT_ON_CLOSE_SET	0x80042459L	A REVERT ON CLOSE volume flag is already set for this volume.
VDS_E_REVERT_ON_CLOSE_MISMATCH	0x80042459L	When clearing volume flags that have been set using revert on close, the same combination of HIDDEN and/or READ ONLY flags must be passed to both the SetFlags and ClearFlags calls.
VDS_E_IA64_BOOT_MIRRORED_TO_MBR	0x8004245AL	Not Used! You have mirrored your boot volume on a GPT disk, to an MBR disk. You will not be able to boot your machine from the secondary plex.
VDS_S_IA64_BOOT_MIRRORED_TO_MBR	0x0004245AL	You have mirrored your boot volume on a GPT disk, to an MBR disk. You will not be able to boot your machine from the secondary plex.
VDS_S_UNABLE_TO_GET_GPT_ATTRIBUTES	0x0004245BL	Unable to retrieve the GPT attributes for this volume, (hidden, read only and no drive letter).

VDS_E_VOLUME_TEMPORARILY_DISMOUNTED	0x8004245CL	The volume is temporarily dismounted.
VDS_E_VOLUME_PERMANENTLY_DISMOUNTED	0x8004245DL	The volume is permanently dismounted.
VDS_E_VOLUME_HAS_PATH	0x8004245EL	The volume still has access path to it.
VDS_E_TIMEOUT	0x8004245FL	The operation timed out.
VDS_E_REPAIR_VOLUMESTATE	0x80042460L	The operation could not be completed. To repair a volume, both the volume and plex must be online, and must not be healthy or rebuilding.
VDS_E_LDM_TIMEOUT	0x80042461L	The operation timed out in the Logical Disk Manager Administrative service. Retry the operation.
VDS_E_PLEX_NOT_REGENERATED	0x80042462L	The operation failed. Cannot retain plex that has not regenerated.
VDS_E_RETRY	0x80042463L	The operation failed. Retry the operation.
VDS_E_ONLINE_PACK_EXISTS	0x80042464L	Create pack operation failed. An online pack already exists.

VSS error messages

Error	Meaning	Corrective Action
VSS_E_BAD_STATE	0x80042301L	A function call was invalid because of the state of either the backup extensions or the coordinator. For example calling AddToSnapshot set prior to calling StartSnapshotSet.
VSS_E_PROVIDER_ALREADY_REGISTERED	0x80042303L	Calling RegisterProvider.
VSS_E_PROVIDER_NOT_REGISTERED	0x80042304L	Calling UnregisterProvider.
VSS_E_PROVIDER_VETO	0x80042306L	Calling DoSnapshotSet.
VSS_E_PROVIDER_IN_USE	0x80042307L	Calling UnregisterProvider, StartSnapshotSet.
VSS_E_OBJECT_NOT_FOUND	0x80042308L	Calling DeleteSnapshots, Query.
VSS_S_ASYNC_PENDING	0x00042309L	Calling IVssAsync::QueryStatus.
VSS_S_ASYNC_FINISHED	0x0004230AL	Calling IVssAsync::QueryStatus.
VSS_S_ASYNC_CANCELLED	0x0004230BL	Calling IVssAsync::QueryStatus.
VSS_E_VOLUME_NOT_SUPPORTED	0x8004230CL	Calling AddToSnapshotSet.
VSS_E_OBJECT_ALREADY_EXISTS	0x8004230DL	Calling ExposeCurrentState.
VSS_E_VOLUME_NOT_SUPPORTED_BY_PROVIDER	0x8004230EL	Calling AddToSnapshotSet.
VSS_E_UNEXPECTED_PROVIDER_ERROR	0x8004230FL	Calling several methods supported by the providers.
VSS_E_CORRUPT_XML_DOCUMENT	0x80042310L	XML document unexpectedly does not match schema.
VSS_E_INVALID_XML_DOCUMENT	0x80042311L	An XML document passes as an argument is not valid, i.e., is either not correctly formed XML or does not match the schema.
VSS_E_MAXIMUM_NUMBER_OF_VOLUMES_REACHED	0x80042312L	We cannot add any more volumes since we passed the maximum limit.
VSS_E_FLUSH_WRITES_TIMEOUT	0x80042313L	VSS couldn't flush I/O writes anymore.
VSS_E_HOLD_WRITES_TIMEOUT	0x80042314L	VSS couldn't hold I/O writes anymore.

VSS_E_UNEXPECTED_WRITER_ERROR	0x80042315L	VSS encountered problems while sending events to writers.
VSS_E_SNAPSHOT_SET_IN_PROGRESS	0x80042316L	StartSnapshotSet was called when another snapshot set in the process of being created.
VSS_E_MAXIMUM_NUMBER_OF_SNAPSHOTS_REACHED	0x80042317L	AddToSnapshotSet was called on a volume that has already reached its maximum number.
VSS_E_WRITER_INFRASTRUCTURE	0x80042318L	The Writer infrastructure is not operating properly. Check that the Event Service and the Volume Snapshot Service are started and check for errors associated with these services in the error log.
VSS_E_WRITER_NOT_RESPONDING	0x80042319L	A writer did not respond to a GetWriterStatus call. This means that the process containing the writer died or is hung.
VSS_E_WRITER_ALREADY_SUBSCRIBED	0x8004231AL	A writer has already successfully called the Subscribe function. It cannot call subscribe multiple times.
VSS_E_UNSUPPORTED_CONTEXT	0x8004231BL	Attempt to use an unsupported context.
VSS_E_VOLUME_IN_USE	0x8004231DL	Calling ChangeDiffAreaMaximumSize
VSS_E_MAXIMUM_DIFFAREA_ASSOCIATIONS_REACHED	0x8004231EL	Calling AddDiffArea.
VSS_E_INSUFFICIENT_STORAGE	0x8004231FL	Calling EndPrepareSnapshots, ChangeDiffAreaMaximumSize
VSS_E_NO_SNAPSHOTS_IMPORTED	0x80042320L	Calling ImportSnapshots, no volumes were successfully imported.
VSS_S_SOME_SNAPSHOTS_NOT_IMPORTED	0x00042320L	Calling ImportSnapshots, some volumes were not successfully imported.
VSS_E_WRITERERROR_INCONSISTENTSNAPSHOT	0x800423F0L	Indicates that the snapshot contains only a subset of the volumes needed to correctly backup an application component.
VSS_E_WRITERERROR_OUTOFRESOURCES	0x800423F1L	Indicates that the writer failed due to an out of memory, out of handles, or other resource allocation failure.
VSS_E_WRITERERROR_TIMEOUT	0x800423F2L	Indicates that the writer failed due to a timeout between freeze and thaw.

VSS_E_WRITERERROR_RETRYABLE	0x800423F3L	Indicates that the writer failed due to an error that might not occur if another snapshot is created.
VSS_E_WRITERERROR_NONRETRYABLE	0x800423F4L	Indicates that the writer failed due to an error that most likely would occur if another snapshot were created.
VSS_E_WRITERERROR_RECOVERY_FAILED	0x800423F5L	Indicates that auto recovery of the snapshot volume failed.

Glossary

This glossary defines acronyms and terms used in this guide or related to this product and is not a comprehensive glossary of computer terms.

API	Application Programming Interface, an interface that allows a software application to connect to and work with a third party software application.
clone	A full copy of a volume, usable by an application.
CV	HP StorageWorks CommandView, a browser-based interface that allows management of an HP disk array.
differential copy	A copy of a database consisting only of the differences in the database since the last full copy.
disk array	A RAID. A collection of disk drives within a cabinet or multiple cabinets and including a controller and software allowing drives to be ganged together in various configurations to create virtual drives (LUNs).
EVA	HP StorageWorks Enterprise Virtual Array.
FC	Fibre Channel, a fiber optic interconnection standard commonly used for storage area networks.
GUI	Graphical User Interface.
HBA	Host bus adapter. The FC interface card that installs in a host to connect the host to a fabric SAN.

HWP	Hardware Providers. A collection of software that executes on the host, a bus adapter, and the disk array to enable managing and/or copying of array LUNs through the Windows OS and applications.
LAN	Local Area Network.
LUN	Logical Unit Number. A physically addressable storage unit as surfaced by a hardware RAID subsystem. A virtual disk, consisting of multiple portions of physical disks addressed as a single unit.
mirror	Synonymous with “clone.”
MSA	HP StorageWorks Modular Smart Array.
plex	A Microsoft term denoting a full copy of data that has been split off from the original and is no longer being updated. Synonymous with “split mirror.”
PVOL	Primary volume. Typically the volume where application data is stored.
RAID	Redundant array of independent disks.
SVOL	Secondary volume. The volume that receives backup copies of data.
SAN fabric	The Fibre Channel hardware and cabling that connects servers to storage devices in a Storage Area Network (SAN) is referred to as a “fabric.” A fabric switch provides automatically-switched connectivity between servers and storage in the fabric.
SNMP	Simple Network Management Protocol.
shadow copy	A Microsoft term describing a point-in-time copy of an original volume. The original volume continues to change as the process continues, but the shadow copy of the volume remains constant.
snapclone	An HP EVA disk array term denoting a full copy of a volume that becomes immediately usable by an application. Created much faster than ordinary clones by taking a snapshot and updating to a full copy in the background.
snapshot	A generic term meaning a static point-in-time copy of a volume, typically used for backup.

split mirror	A full copy of data that has been split off from the original and is no longer being updated.
subsystem	Synonym for “disk array” or “RAID.”
SVP	Service processor. A laptop PC built into the HP XP Disk Array. The SVP provides a direct interface into the disk array, and is used by the HP service representative only.
volume	Generic term for a number of physical disks or portions of disks logically bound together as a virtual disk containing contiguous logical blocks. Volume can also be software shorthand for a mapped volume (Windows drive letter or mount point).
VDS	Microsoft Virtual Disk Service, the Windows service that manages storage through hardware providers.
volume shadow copy	See “shadow copy.”
VSC	Volume Size Configuration, a feature of HP disk arrays that allows creation of logical volumes custom-sized according to user requirements.
VSS	Microsoft Volume Shadow Copy Service, the Windows service that creates data copies. Works through HP HWP to make copies of disk array volumes.
XP	HP StorageWorks XP Disk Array.

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